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THE AMERICAN
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EDITORIAL

SALUTATION.

With very little ceremony we have just "basketed" a dusty calendar that did yoeman service over our desk for the past Gregorian year. Ink pocked and finger marked, it bore mute testimony to days of work, to days of rest, to tales of joy and to tales of suffering, and it had earned for itself in point of service a fate much richer than it received.

In its place there is a glossy-surfaced herald, immaculate and promising. Writ upon its surface but un-understood by man are many characters, some breathing joy and some with sorrows brimming. But there is visible clear across its every page at least one word that every one can see, and it brings to the heart the fullness of hope and the blessed privilege of waiting.

It is the most promising word in the English language. We have recently seen it on an editor's card of Christmas greeting. It is the word *Expect*. And the editor tells us this: " 'Expect,' says George Mathew Adams, "is one of the most inspiring words in the English language; it means that you believe that the things which you want will be given to you and that to which you look forward will come to pass. Some expectations are transformed to serve a better purpose; all can not be realized, but hope adds much to our life." And it is human, and beautifully human to be able to see on every calendar, in screaming letters, this wonderful pæan of hope, the word EXPECT.

It is our privilege with the close of one year and the advent of another to thank our contributors for their kind manifestations of co-operation, and we urge upon them to continue their evidence of friendship to this honored and historic journal. We also extend

our thanks to an ever-widening circle of readers for their patience with us in our humble efforts to serve them. We promise for them a continuation of our best efforts to provide readable and worth-while material—not too scientific and anhydrous, nor too light and effervescent, but rather with a view of pleasing him who "readeth for diversion" as well as him "who readeth for profit."

I. G.

REACHING OUT.

The Philadelphia College of Pharmacy and Science was founded to meet the educational needs of the apothecaries' apprentices of Philadelphia and its suburbs. As time passed, the renown of this purely local institution spread, and in due course, students came from remote regions of this country, and latterly, also from foreign countries. There have been enrolled, within recent years, students representing Canada, Cuba and other islands of the West Indies, Mexico, countries of Central and of South America, as well as Egypt, Japan and China.

After graduation, foreign students return to their homes with a friendly interest in all which is American. American text books and scientific journals, will thus be introduced into foreign lands. They will know about our products, and about our markets as a source of supply for their needs as they follow their chosen profession. Even American standards and American practice will be adapted to their own native requirements. They may be counted upon to do much in establishing and fostering friendly relations between their respective countries and our own. An institution of learning which brings students from distant countries, and trains them well in their chosen profession is, therefore, a national asset of inestimable value.

Yale is breaking ground for a new chemistry building which, including the equipment, is to cost three million dollars. And Professor Treat B. Johnson, who occupies the chair of organic chemistry, makes the statement that it is planned to make Yale a great chemical center, particularly for foreign students. But is not our College the logical center for pharmacy, and also for chemistry, and bacteriology, as far as these link up with medical practice, and

with the manufacturing of medicinal products? And should we not have similar ambitions, and set out to do in our particular field the very thing which Yale is planning to do in its field?

Think of what it would mean, in the matter of service to the country, if we could send out each year, ten or twenty times as many foreign students, trained in American science, and imbued with American ideals, as we shall send out this spring. And it can be done. No other College occupying the same field has the advantages which are ours when it comes to drawing foreign students. Our College is the oldest of its kind and is known—favorably known—wherever pharmacy is practiced. We have a good start, and have hundreds of our graduates practicing in foreign lands, where they are conspicuous because of their attainments. We have the AMERICAN JOURNAL OF PHARMACY with its large subscription list. Our geographic location is most advantageous, for Philadelphia is not only a great center of medical learning, but is the great industrial center of the country—certainly as to the chemical industries, and the manufacture of medicinal products. Moreover, we are in a position to offer post-graduate courses, and a foreign student can here prepare for the higher fields in his profession.

To extend the sphere of influence of this College in the manner suggested, we must, if we expect speedy results, proceed precisely as Yale is proceeding; we must build and equip generously. Happily, our President, Admiral Braisted, and our Board of Trustees, are fully conversant with the opportunities and the possibilities of P. C. P., and are laying plans to provide a splendid physical equipment, to meet the needs of the expanded educational programme, and the increasing student body, from our country, as well as from abroad.

The College will continue to be essentially an American institution, primarily for American students; but as foreign students turn to America for the higher education, which it was formerly the custom to obtain in Europe, we may reasonably expect them to come to us in rapidly increasing numbers, for pharmacy, certain branches of chemistry, bacteriology, and for pharmacognosy. And our officers are planning accordingly, as did the institution in Connecticut.

J. W. S.

ORIGINAL PAPERS

STRAWBERRIES AT THE NORTH POLE AND APPLES AT THE EQUATOR.*

By Heber W. Youngken, A. M., Ph. D.

The possibility of partaking of strawberries and apples in regions of the earth remote from their native habitats and districts of production at first thought seems unlikely. Upon later reflection, however, the likelihood seems possible, since we realize that they may be canned, dried or even refrigerated. But the chance of being able to have them in a condition almost like that in which they would appear when gathered in fresh from the garden or orchard and placed on the table with little or no natural flavor removed, after transportation to either of these remote points is a far different proposition. Yet I hope to show before the conclusion of this lecture that the ingenuity of man has made it quite possible to enjoy not only the full flavor and flesh of strawberries and apples in arctic or torrid climes but in addition other fruits, vegetables and meats which are not produced in these regions.

The whole secret of being able to procure the kind of food you want where and when you want it is in its preservation. The reasons foods do not normally keep indefinitely are partly biological and partly chemical. The chemical agents responsible for food spoilage are called enzymes; the biological agents, microörganisms. All living cells of plants and animals normally contain enzymes that possess the power of changing substances insoluble in water into water-soluble substances without themselves suffering any change during their term of activity. These enzymes are produced by the living matter of the cell and remain active after the death of the cell. Some of them have the power of attacking carbohydrates such as starch or inulin, breaking these substances down into water-soluble sugars, others attack proteins such as albumens and globulins, splitting these up into water-soluble peptones, etc., still others attack fats, breaking them down into water-soluble fatty

***An illustrated public lecture, delivered at the Philadelphia College of Pharmacy and Science, Thursday evening, November 17, 1921.**

acids and glycerin. Some of the enzymes are present in the cells of the food itself, others occur in the cells of microörganisms which attack food. All enzymes require a certain amount of warmth and the presence of water in order to get in their activity.

From the earliest period of the human race of which there are records man has strived to preserve foodstuffs available in season and region of abundance for use in times and places of scarcity. The ancients practiced sun-drying of food on a large scale.

The following are the methods chiefly employed in the preservation of foods: (1) drying, (2) salting, (3) pickling, (4) smoking, (5) refrigeration, (6) canning, (7) dehydration.

DRYING OF FOOD.

The methods upon which foods are dried are based upon the principles that sufficient heat kills enzymes and the removal of water inhibits the growth of microörganisms as well as prevents enzymic activity. In some instances protective layers may be formed through drying by changing the former relationships of tissue constituents. Thus, for example, in the curing of pork, the fat which is for the greater part isolated in distinct cells becomes diffused throughout the outer layers of the flesh and forms a waterproof exterior to the ingress of microörganisms.

The removal of water in foods to an extent below the minimum required for the growth of microörganisms is secured in a number of ways. The most common ones are the uses of heat either in the form of sun's rays or from an artificial source.

Sun drying is the oldest of these. In regions where the moisture content of the air is low, as in many of the fruit districts of California and other western states, exposure to the sun's rays accomplishes rapid drying. In this method insects and dust frequently have full access to the food.

In more humid localities and with other types of food, artificial heat is employed and so we have kiln drying and drying by means of centrifugal action.

Kiln drying is much employed in the preparation of evaporated foods. In this method materials are laid on a screened floor under which heating appliances are built. The mass of material is stirred up occasionally during the drying.

Drying by heat always results in concentrating the solutes.

The acids in the juices of many fruits, when concentrated, may be antiseptic, *i. e.,* retard the growth of microörganisms. Frequently the sugars present reach so great a concentration as to plasmolyze the cell contents of any microörganisms present and so prevent their multiplication.

The disadvantages of all of these methods of drying lies in the facts that they are slow, not all materials can be so treated and the products resulting do not regain their natural appearance, odor or taste when prepared for diet.

SALTING.

This is a method of preserving meats and fish. It has been used for many centuries and next to drying is the oldest process known. It is dependent upon the principle that salt abstracts water from the tissues of the fleshy food and so causes a concentration of the solutes within the cells too great for the growth of bacteria. It gives the food a paler color and extracts at least 25 per cent. of the protein content. The great disadvantage in this method is the danger of undersalting or oversalting. Undersalted foods putrefy in time. Frequently the putrefaction is masked and ptomaine poisoning occurs after eating these.

Oversalting destroys the natural flavor and extracts much of the nutritive substances.

PICKLING.

Pickling consists of the preservation of food in brine containing varying percentages of salt, vinegar, weak acids and occasionally condiments. Many foods such as olives, cucumbers, cauliflower, beets, and some meats and fish are preserved by this method. That pickling is not always a safe method of food preservation has recently been emphasized by many outbreaks of botulism poisoning from pickled ripe olives.

SMOKING.

This is a method of preserving flesh foods and flesh derivatives such as meat and fish. It consists of first placing the fleshy food in brine with or without condiments for a week or longer. A smoldering fire is then built in a specially constructed chamber.

The flesh foods are taken out of the brine and hung up, being exposed for varying periods of time to the wood smoke and heat.

The volatile substances in the wood smoke such as creosote, formaldehyde, acetic acid and other germicidal substances penetrate the food at least superficially and either kill any putrefactive organisms present or retard their growth.

REFRIGERATION.

Refrigeration is a method of preserving foods which is based upon the principle that cold inhibits the activity of microörganisms. During the past two decades it has revolutionized the meat and egg industries. In the meat industry it permits slaughtering to take place all the year round and great cargoes to be transported in refrigerating chambers across oceans and continents and through equatorial regions not much the worse for the transporting.

Foods preserved by refrigeration generally command a higher price than those preserved by other methods. This is in part due to the fact that the general appearance of cold storage food resembles that of the perfectly fresh article. In numerous instances, also, refrigeration, for a reasonable length of time, preserves not only the appearance but also the delicate flavor, chemical composition and nutritive value of the original articles.

During the storage of food it undergoes some loss of water and volatile principles by evaporation and various volatile principles may be absorbed from the air of the storage room. But by far the most important point to be considered in this connection is the behavior of the biologic content of the food during this period. It should be emphasized here that refrigeration not only impedes the growth of microörganisms but tends to preserve them as well. In addition to the organisms present in the food when it is stored, other microbes such as bacteria, yeasts and molds, may gain access to the food from time to time either by actual contact with other things or through the circulating air within the cold storage chamber.

As to whether these implanted forms will survive depends upon their nature and ability to adapt themselves to the conditions existing within the stored food. Some perish, others may survive in the passive condition, still others may survive in their active form, multiplying rapidly.

It has been known for some time that some bacteria can grow at a temperature of zero and that many can reproduce at a fraction of a degree above that point. If microbic activity is, therefore, to be inhibited, the food must be frozen.

Methods of refrigeration vary depending upon the article to be refrigerated. In the production of chilled meats, the flesh of mammals is first placed in a cold chamber at a temperature of about $+2^\circ$ for the first forty-eight hours and then stored at a temperature of $+1^\circ$ or $+2^\circ$, if chilled meat is desired. During the chilling process the enzymes of the dead flesh and bacteria present are active, bringing about a ripening or curing, which makes the meat more tender and gives it a more desirable flavor. If the chilling process be allowed to proceed beyond the point where the muscle sugar is nearly completely fermented, the changes in the meat due to the decomposition of proteid material by bacterial enzymes makes it dangerous and unfit for consumption.

In the preparation of frozen meat, the dressed article is chilled in an air-chamber at -20° until it is frozen solid and later kept at a temperature of below -4°. Such meat remains practically unchanged for long periods. The difficulty arises when it is thawed. If warmed slowly the melting water crystals are absorbed by the protein material and the original structure of the flesh restored almost completely, but bacteria are always bound to enter in a prolonged process of this kind and cause some decomposition.

In order to prevent this the thawing is usually carried on rapidly and so the normal structure of the meat is not restored. It is softer, darker and moister than chilled or fresh meat and prone to rapid decomposition if kept at room temperature for even short periods.

In the refrigeration of fish and poultry, these articles are chilled by packing in ice immediately after death and frozen as rapidly as possible. In thawing similar changes take place as in frozen meat but the bacterial decomposition proceeds more energetically. After thawing is complete the products spoil rapidly.

Eggs should be stored at a constant temperature which should be between $+0.5^\circ$ and $+1^\circ$ and at a constant humidity of 70 per cent. saturation, if superior results are to be attained. But even with the best of control and precautions there is some deterioration in the cold storage article due to the facts that the enzymes within

the egg are not necessarily inhibited nor is the growth of all of the bacteria prevented.

Milk is more rapidly changed by bacterial activity than any other food. In up to date dairies it is therefore cooled immediately after it is drawn from the animal and kept at a low temperature until delivered to the consumer. But even at this low temperature the milk bacteria multiply slowly. Freezing alone prevents their multiplication. If the milk is very clean, however, it may be kept sweet for several weeks at a temperature slightly above the freezing point.

Fruits and vegetables are refrigerated at a temperature slightly above zero and at a constant humidity at about 60 per cent. saturation.

In spite of modern methods of refrigeration it is not practicable to ship fresh sea foods to distant inland towns or to send some perishable fruits and vegetables of the tropics to colder climes.

CANNING.

Canning is a method of food preservation the principles of which include the destruction of microörganisms which produce the fermentative and putrefactive changes by heat and subsequently sealing the container to prevent the access of more microörganisms.

The principle of employing heat in the preservation of food had its origin in the experiments of Spallanzani, who in 1765 boiled meat extract in flasks for an hour and hermetically sealed them, after which no change took place in the material. Spallanzani, however, was not aware of the real cause of these changes.

About the middle of the nineteenth century Tyndall and Pasteur successfully demonstrated that living microörganisms were always found where fermentation and putrefaction took place, that these organisms could be killed by heat and that if substances liable to decomposition which had been sterilized by heat were kept so that no organisms could gain entrance, they would keep indefinitely without spoiling.

But long before the causes of fermentation and putrefaction were known canning was discovered.

During the Napoleonic wars, the French Government faced the problem of maintaining an adequate supply of food for their

army and navy and offered a prize of 12,000 francs to the person who could invent the best method of preserving food. Stimulated by this offer, Nicholas Appert a Parisian confectioner, undertook the task. After several years of ardent investigation he discovered a method which he submitted to the Minister of the Interior. A number of substances which Appert had preserved, including meat, vegetables, fruits, milk and soup, were examined by the Bureau Consultif, a commission appointed by the minister, which included such men as Gay Lussac, Bardel, Scipion-Perrier and Molard.

This body reported that when the jars were opened after several months, the foods were found to be perfectly preserved and in every way satisfactory in flavor and appearance. On the strength of this report Appert was awarded the prize of 12,000 francs. It was not until the following year (1810) that Appert published his discovery under the title of *"L' Art de Conserver pendant plusiers toules les substances animal et vegetables"* ("The Art of Preserving Animal and Vegetable Substances.")

Appert's method consisted of enclosing food in glass jars which were then corked tightly, placed in a bath of boiling water, the time varying according to the article treated and taking the jars from the bath at the prescribed time and in a proper manner. Appert later used tin cans as containers.

The success of Appert's method was dependent upon sterilization and the absolute exclusion of air. These same principles are applied in the canning of today.

From France the canning method was introduced into England by Peter Durand, who in 1810 obtained a patent from the English Government for the preservation of a variety of foods in hermetically sealed tin cans and glass jars.

Among the first to introduce the process into the United States were Ezra Dagget and Thomas Kensett, who in 1819 began to manufacture canned oysters, lobsters and salmon.

In 1820 William Underwood and Charles Mitchell opened a canning factory in Boston, where they packed currants, plums, quinces and cranberries.

Enormous losses were experienced during the early years of the canning industry due to defective nature of the square tin cans. The square can finally gave way to the economically superior round can.

A press for manufacturing can tops was invented in 1850.

In 1883 a hand capping machine was patented and later various other kinds of machinery replaced hand labor.

The Civil War did more to stimulate the canning industry in America than any other factor. Today it is recognized as the main method of preserving foods in this country and likewise the most popular.

DISADVANTAGES OF CANNED FOODS.

It is a well known fact amongst chemists and physicians of today that the heat necessary to bring about the successful sterilization of milk, fruits, vegetables and meat destroys vitamines. These vitamines are regarded as absolutely essential for the growth, development and the protection of the body against certain diseases such as scurvy and beri-beri.

In writing on the vitamines, Col. Vedder, M. C., U. S. A., states: "It should also be noted that all canned food must be regarded as possible beri-beri producers. It has been shown by numerous investigators, including the writer, that heating to 120° C. destroys the beri-beri preventing vitamines in certain foods. All protein foods that are 'canned' must be subjected to about this amount of heat in order to kill all the putrefactive organisms and such canned foods are, undoubtedly, beri-beri producers when used in excess."

I have recently been informed by Mr. P. R. Buettner, of Danbury, Connecticut, that canned tomatoes retain some of their natural vitamines due to the protective power of the acid in this fruit during processing.

The second disadvantage of using canned goods is in their great cost of production. From four to seven ounces of tin plate are used for each container. To this must be added the cost of packing cases and the handling, canning and transportation of much water.

A third disadvantage is the fact that they have limited keeping qualities. There is always danger of crushing and spoilage in transporting them.

Moreover, most of these products, when prepared for the table do not possess the same appearance, odor and taste as those of the freshly prepared articles from the field or garden.

DEHYDRATION.

Dehydration in the modern sense of the term may be defined as the process whereby perishable foods with or without previous treatment are subjected to the action of carefully regulated currents of air in which the temperature and humidity are properly controlled.

The method results in the food products gradually losing water, but without giving up their color or flavor or having their cellular structure impaired. Accordingly, the dehydrated food will reabsorb water, swelling up to its normal size and appearance. When cooked it will have the same appearance, flavor and odor of freshly cooked material made from fresh vegetables.

Dehydration dates back to 1850 when Masson, a Frenchman, dried a large number of vegetables and fruits with a blast of warm air at a temperature near 70° C. Sometime later Passburg of Berlin obtained excellent results with vacuum drying apparatus. It was not, however, until the Boer War that products of this nature began to be manufactured on a considerable scale. During this period many thousands of pounds of dried vegetables, mixed so as to form a basis for an easily prepared soup, were produced in Canada and shipped from there to the British Army in South Africa.

Stimulated by the possibilities of marketing products of this nature on a commercial scale a number of Americans established factories in this country and by 1910 began to manufacture dehydrated vegetables and soup mixtures. These products, however, never became popular, partly because they were not quite equal to the fresh article, when cooked, and partly because of the great popular demand for canned foods.

War is without doubt a great stimulator of human ingenuity, no less in perfecting methods than in inventing new ones.

Just as the Civil War stimulated the introduction of new methods in the canning industry, so the World War established new methods and perfected older ones in the dehydration industry.

With the problems of supplying our armies in distant fields and our ships in foreign seas with a variety of foods, and the limit of our tonnage, the food situation became acute. More and more demands were made by the government for dehydrated products in order to save transportation of water and to provide our fighters with fruits and vegetables that could not be obtained in England

and France. Thousands of tons of these foods were shipped abroad during the World War to the forces of the United States as well as the Allies.

It was the dehydration process that probably enabled Germany to maintain her food supplies during the war. That it was successful in that country cannot be doubted when we consider the following statistics: In 1898 there were only three small dehydration plants in Germany. Eight years later the number in operation was thirty-nine, in 1914 it had increased to 488, in 1916 to 841 and in 1917 to about 1900.

By August first of this year there were twenty-nine concerns manufacturing dehydrated fruits and vegetables in the United States. To this may be added at least a dozen firms who manufacture dehydrated animal products.

The methods of dehydration employed at the present time are varied in details of procedure. All, however, are founded on the same basic principle, namely, to remove the water contained in and between the cells of the food so as to obtain a product which cannot spoil as a result of microbic or enzyme action.

The water taken away by these methods is only replaceable water and so the nutritional value of the food has not been altered. Moreover, if dehydration is applied while the fruits, vegetables or animal products are absolutely fresh, the flavor-giving substances are preserved intact. In the best grades of dehydrated products the rate of evaporation is such as to bring about the removal of water without rupture to the cell walls.

By means of this process the weight of the food is reduced from 80 to 90 per cent. and the bulk is diminished to one-fourth or one-sixth of the original volume. By means of compression the nearly dried material may be brought to a compact form, as, for example, in the Veco products. Not all the water is removed, the amount remaining varying depending upon the character of the food to from 7 to 15 per cent. But sufficient is removed to concentrate the solutes to the extent of producing plasmolysis.

The manner in which the material is prepared influences to some extent the quality of the product. If the first temperature applied to the fresh material is too high certain changes take place in many vegetables giving them an appearance of scorched or scalded substances and diminishing their water-absorbing power.

Accordingly, in dehydrating vegetables, the fresh material should be subjected to air having a low temperature and high humidity and gradually brought to a high temperature and low humidity.

METHODS OF DEHYDRATION.

The methods of dehydration employed at the present time are as follows:

1. Tunnel Systems. These consist of long chambers or tunnels into the end of which the fruits or vegetables are introduced on screens or racks and through which a strong current of dry air is blown. While there are several modifications in the arrangement of the screens and in the method of heating and driving the air, it may be said that in general the heat is supplied by coils of steam pipe and the air is forced in by powerful fans. In some plants the racks of vegetables are placed on trucks which run on tracks, so that the material is introduced at one end of the tunnel where the temperature is low and humidity relatively high, gradually moved on to where the temperature is higher and the humidity relatively lower and delivered at the other end in dry form. By this means the moisture is uniformly extracted by capillary attraction without destroying the cell structure. On account of the gradual reduction of the moisture content, the cells shrink slowly without breaking down and the product retains all of its natural flavor, color and food value. In other plants the tunnels have side openings where the trays are inserted and removed by hand.

In the Hammond tunnel system, the patents of which are owned and controlled by the United States Dehydration Company of Denver, Colorado, the prepared fruits, vegetables or animal foods are placed in a rectangular tunnel and gradually conveyed through it, the moisture, temperature and rate of air flow all being properly coördinated. The air is allowed to take its course straight through, passing over the top of the trays or underneath them.

Most of the products are steam blanched or dipped in hot water before being introduced into the drier, which operation has been found quite necessary in preserving the color and keeping qualities of vegetables.

The Cook-Kelly process employed in the manufacture of "Cookelized foods" is another of these tunnel systems. In prepar-

ing foods by this process, fruits and vegetables are brought into the factory and washed, peeled, pared, sliced, cubed or riced, put on wire screen trays and placed in a rectangular tunnel approximately thirty-five feet long. Heated air is blown through this tunnel, the currents of this air taking the form of a sine curve as they go upward through one tray and downward through the next and so on. The trays are shoved along periodically which causes the air to reverse its passage through the products on the tray from time to time, evaporating the moisture from the products and carrying the moisture off through the other end of the tunnel.

2. Vacuum Methods. These have been employed with success in the dehydration of fruits, vegetables and animal products.

The apparatus consists of a heavy cast iron chamber containing a large number of steel shelves heated either by steam, hot water or electricity, a condenser, and a vacuum pump to exhaust the air from the chamber and maintain a high vacuum on the system.

The material to be dried is placed on flat screens which slide into the shelves. Heating is partly by conduction from the metal trays and partly by radiation from the next shelf above. The temperature is regulated by a thermostat, so that overheating is impossible. Through the constant application of a vacuum to the process, the water vapor is removed and the material dehydrated.

This method is particularly advantageous for the dehydration of potatoes and apples or other vegetables containing an oxidase ferment. It is this ferment which causes the darkening of such materials when their flesh is exposed to the air. Since air is removed from the chamber, no darkening results by this process. However, if such vegetables are subsequently placed in water, darkening will result, since the ferment has not been entirely destroyed. This is overcome by blanching or steam treatment before the foods are dehydrated.

In the dehydration of milk and eggs by the vacuum method, heated rollers are employed. These, with various attachments, are enclosed in a chamber in which a high vacuum is maintained. The heated roller picks up a film of egg-pulp or milk which dries rapidly under reduced pressure and is continuously scraped off by a knife as dried flakes or powder.

In the dehydration of meats, this method is probably unequalled by any other one in its effectiveness. Large steaks and chops can be handled without oxidation and completely dried. The fats remain white and are not melted. The product is essentially raw meat with water removed. Usually a temperature of 130° F. is employed.

Fish, lobster meat, clams, oysters, shrimps and other protein foods that ordinarily putrefy easily can be preserved in excellent form by this method. Since these products are dried to about 30 to 35 per cent. of their original weight, the concentration of the solutes is too great to permit bacterial development.

Most fruits and vegetables require higher temperatures than those to which flesh foods are subjected when dried by this method.

With some of the products this method gives good results but is rather severe with others, tending to break down their cellular structure.

3. Kiln Method. In this method of dehydration, square chambers with sloping roofs and perforated floors are utilized. The floor is heated from below by a stove or furnace. The materials to be dehydrated are spread on the floor to a depth of four or six inches. The hot air from the heating device passes up through the vegetables, removing the moisture, which is conducted through a ventilator in the roof. The mass of vegetables is turned over now and then by men with shovels during the drying. The advantage of this method is mainly its cheapness. The disadvantages are those of overheating or underheating. However, a number of products made thereby have proven satisfactory.

4. Special Dehydrators. A number of special types of chambers or machines are now in use, differing from those previously considered only in certain details of construction. Many of these have appliances to carefully regulate the drying.

KEEPING QUALITIES OF DEHYDRATED FOODS.

That dehydrated foods will keep for a long time, if properly prepared, is evidenced by the following occurrence: During the Boer War the British Army in South Africa was supplied with thousands of pounds of dehydrated vegetables mixed so as to form

the basis of a quickly prepared soup. At the close of the war one of the Canadian manufacturers was left with 30,000 pounds of this mixture for which he could not find a market probably due to the fact that consumers much preferred to buy such vegetables in the recent condition. He placed it in barrels which were paraffined and stored it away. Fifteen years later, after the outbreak of the World War, these were shipped to the British Army in Europe and used in the preparation of soups of splendid quality.

If dehydrated foods are properly prepared and kept in paraffined containers free from insect pests and ingress of moisture, there seems to be no reason why they should not keep for indefinitely long periods.

ADVANTAGES OF DEHYDRATED FOODS OVER OTHER PRESERVED PRODUCTS.

Dehydrated foods are superior to dried or evaporated articles because they regain the natural appearance and keep the natural odor and taste of the fresh article, when prepared for the table. Moreover, they have better keeping qualities.

Their advantages over refrigerated articles lies in the saving of cold storage charges, in the lessened transportation charges and in their superior keeping qualities.

Their advantages over canned foods lie in the great saving in freight charges (since the water content is reduced to 5 or 10 per cent.), in their freedom from spoilage, their greater ease of handling, their superior keeping qualities, and in the cheap containers that may be used. Moreover, there is no danger of botulism, nor are any of the vitamines destroyed.

Dehydrated foods can be shipped to any part of the globe without deterioration.

POSSIBILITIES OF DEHYDRATION IN THE UNITED STATES.

While much has been accomplished in the field of dehydration in the United States since the beginning of the World War, the surface has only been scratched. A goodly number of vegetables, fruits and a few animal products are being dehydrated successfully while scores of others have not as yet been taken up.

Each kind of vegetable or animal food must be studied separately in order to properly perfect its best means of drying by this method.

Dehydration is destined to stabilize the crops of the nation. Year after year, decade after decade, we are confronted by either feast or famine in respect to certain fruits or vegetables.

A good crop one year with correspondingly low prices has often been followed by a small crop the following year with high prices. With an extension of this industry the surplus of years of great yield can be stored and made available in later years when prices are higher and the crop leaner. In a short time the amount of planting would be equalized and all would be able to secure an adequate supply of these foods at normal prices.

Again, dehydration is destined to conserve food materials. It is a notorious fact that about half of the perishable fruits and vegetables grown in this country is wasted annually on the farm, at the freight station, in transit or in the hands of the commission merchant both as a result of poor transportation facilities and irregularities in marketing.

According to the *Los Angeles Examiner,* "only 40 per cent. of the California products contributed to relieve the famine sufferers in China ever reached them in edible condition." "Had the wasted 60 per cent. been dehydrated, it would not have failed of its merciful purpose."

Again, on account of the strict grading laws enforced by the Potato Growers' Associations, it is estimated that about 50,000 bushels of No. 2 undersized, sound potatoes are annually lost to farmers.

The potato dehydrating industry is comparatively recent in America and dehydrated potato flour is being manufactured from some of the previously wasted material. With the spread and development of this and other allied industries much of what had previously been wasted will be conserved for the benefit of the people. The dehydration of the sugar beet and the banana offer wonderful possibilities in this direction.

It is conceivable that dehydration now in its infancy, will within the next decade, when the nature of its products become more generally known, rival, if not outstrip, the other processes of preserving foods.

A CENTURY OLD CHEMICAL DICTIONARY.

By JAMES F. COUCH.

In a recent little volume[1] Dr. Edgar F. Smith has described the lifework of one of the earliest of American chemists, James Cutbush. While the whole essay will prove of interest to the scientific reader, pharmacists will be especially interested in learning that Cutbush styled himself "chemist and apothecary" and that, in 1812, he advertised a course of lectures on "theoretical and practical pharmacy" probably delivered "at the Laboratory in Videl's Court, in Second, near the Corner of Chestnut St." in Philadelphia.

It is not my purpose to discuss the excellent contribution of Dr. Smith. That has already been most satisfactorily done by the pleasing pen of Dr. C. E. Munroe.[2] But I wish to call attention to one of the many publications of Cutbush, perhaps not his most important contribution to American scientific literature, but one which serves the very useful purpose of a base from which to measure progress. In 1821, a century ago, Cutbush published his *"A Synopsis of Chemistry, Arranged Alphabetically: comprehending the names, synonima, and definitions, in that science."* This is a little book of 85 pages, 9 by 14 cm. in size, bound in boards and it appeared at the time when the author was acting professor of chemistry and mineralogy in the United States Military Academy.

The chief interest of this work is that it presents a general view of the state of chemical knowledge just a century ago and permits us to observe the advances and the changes which the past hundred years of intensive scientific activity have occasioned.

Much of the old involved nomenclature of early chemistry is present. We read of "hydriocyanic acid" (p. 30) and of "hydro-oxydates" (p. 31) yet, throughout the book, there is a minimum of this sort of terminology and the whole is clear, concise, and phrased in simple language. There is not a chemical formula in the entire text which is not surprising for the theories of valence were not yet formulated. We must remember that Kolbe was born in 1818, Frankland in 1825 and Kekulé in 1829.

[1] James Cutbush, "An American Chemist," 1919.

[2] Book Review, *J. Am. Chem. Soc.* 43, 1743 (1921).

Some of Cutbush's definitions can hardly be improved upon at the present day. Chemistry he defines (p. 17), "That science, which treats of the action of bodies on each other, and having, for its object, the discovery of their constituent principles, the results of the various combinations, and the laws by which these combinations are affected." Analysis is defined (p. 10), "The separation of a substance into its constituent parts." Carbonates (p. 15), "Salts formed by the combination of carbonic acid with a base." He possessed a clear idea of neutralization, (p. 45), "When certain substances unite, and lose their individual properties, they are said to neutralize each other."

Cutbush, too was up-to-date. He speaks of "molecules," of iodine, which had recently been discovered, of compounds (although he does not define this term), and says of "phlogiston" (p. 52), "An imaginary element. A constituent part, it was thought, of all inflammable bodies."

He includes notices of "morphia," "nicotin," and "strychonin." Of maceration he says (p. 37), "The process of softening a substance, by steeping it in a fluid, without impregnating the latter." This is, of course, quite contrary to the modern meaning of the term. Rectification is (p. 63) "Distillation repeated as often as circumstances require."

The erroneous or primitive ideas prevalent at the time find expression in the definitions for latent heat (p. 36) "Heat chemically combined, not appreciable by the senses," oxydes (p. 49) "Combinations of oxygen with different bases, not possessing, strictly speaking, acid properties," and for affinity which may be "single," "double," or "disposing." Disposing affinity apparently is emulsification; double affinity is what we should now term double decomposition. Single affinity is defined (p. 7), "When two bodies are united and are separated by a third, single affinity is said to take place." Hydrogen peroxide is termed "peroxidized water" (p. 51) and fermentation (p. 24) is "A peculiar spontaneous process, which bodies undergo, when exposed to a proper degree of heat, and for a certain length of time." Nevertheless we suppose that the factitious blondes were as attractive and the brewed products as seductive then as at any time since.

Magniloquent titles are not lacking; bread making is "panification" (p. 51), the art of assaying metals is the "docimastic art"

(p. 22), "eliquation" is the separation of substances by fusing out one of them. Sir Humphrey Davy is accused of fathering the terms "phosphorane" and "phosphorana" for the tri- and pentachlorides of phosphorus respectively (p. 52).

Boric acid is termed "narcotic acid" (p. 45) and "narcotic salt" (p. 66). While nitrogen is "mephitic gas" (p. 11), carbon dioxide is "mephitic acid" (p. 39). Carbonic acid is "calcarious acid" (p. 14) and the "acid of sugar" or "saccharine acid" is oxalic acid (p. 72) probably in reference to its production by heating sugars with nitric acid. Coagulation is defined (p. 18), "An operation, by which fluids are made clear, by the use of serum and albumen, and the application of heat." "Butter of Arsenic" is arsenic pentachloride (p. 14) and "green fecula" is the term given chlorophyll (p. 24). A gas is (p. 27) "A combination of a base with caloric; as hydrogen and caloric, forming hydrogen gas." Elements (p. 23) are "first principles. Simple substances. Undecomposable substances," and effervescence is "the sudden escape of a gaseous substance, accompanied with an intestine motion," (p. 23).

As an instance of the medical superstition then prevalent Cutbush's definition of "miasma" may be quoted. "Matter of contagion. Certain bodies are known to exist in the atmosphere, we will not say combined with it, which exert a powerful action on the human body, and which have been termed *matter of contagion.* Miasmata may proceed from the decomposition of vegetable, or of animal substances, and the atmosphere may be tainted by other causes. In all cases, however, it has been supposed, that a certain noxious matter is dissolved in, or diffused through the air, and that by the action of this matter on the living body certain diseases are produced. When noxious effluvia arise from putrefaction, it is known that certain agents will destroy it; hence the vapor of nitric acid, of muriatic acid gas, and of oxymuriatic acid gas, or chlorine, have been used with great success, in disinfecting air." (p. 41.)

From the foregoing one can appreciate the mists which clouded the conceptions of chemists a century since. Superstition, thaumaturgy, fallacy had to be removed, a science had to be organized and a simple practical system of notation had to be invented. Very little of our present chemical knowledge existed and what there was appears ill-defined and not coördinated. The tremendous importance of the contributions of such men as Berzelius, Liebig,

Dumas, Gerhardt, Pasteur, Faraday, van't Hoff, and Fischer, with their contemporaries stands forth in *alto relievo* when we contrast the present year with hundredth predecessor.

Much of Cutbush's text is now only curious; some of it is rather absurd. We cannot help but hope, however, that since this sort of thing is one way of measuring progress, our successors in 2021 will find much of our present thought ancient and perhaps a trifle ludicrous.

A CHANGING VIEWPOINT.

DR. HENRY LEFFMANN,

Lecturer on Research at the Philadelphia College of Pharmacy and Science.

[French scientists are giving earnest attention to the changed views as to the nature of matter and energy brought about by the electron theory and the doctrine of relativity. Several works have recently appeared extending the application of these to almost complete reversal of the usually accepted ideas. While the doctrine of relativity has found enthusiastic supporters in France, it has also found strong opponents, so that it may be said that intellectual Gaul is now divided into two parts. A work by Louis Rougier, a professor of philosophy in Paris, contains a statement of some of the newer views. Issued under the title *"La Materialisation de l'Energy,"* the book has been translated into English by Professor Masius, of the Worcester Polytechnic Institute, as "Philosophy and the New Physics" (Blakiston, Philadelphia).

The text given below is a close translation from the original French and is presented as a summary of some of the new views on the relation of matter and energy. Many will find the statements strange, but it must be remembered that theories that are now generally accepted were condemned when first propounded. This was the case with the stereochemic formulas, especially the benzene ring theory of Kekulé.

As a commentary on the claim for newness the following dialogue from a Greek farce, *"The Clouds,"* by Aristrophanes, which is more than twenty-three centuries old, may be quoted.

Strepsiades.—You swore, just now, by Jupiter.

Phidippides.—I did.

Strep.—See what a good thing learning is. There is no Jupiter, O Phidippides.

Phid.—Who then?

Strep.—Vortex reigns, having expelled Jupiter.

* * * * * * * * * *

Phid.—Who says this?

Strep.—Socrates, the Melian, and Chaerophon, who knows the footmarks of fleas.

Henry Leffmann.

The discoveries of modern physics have led physicists to two very distinct conceptions of the universe. One of these can be designated as the "dematerialization of matter." Its essence is that it reduces the conception of matter to individual points of stress, condensation and even annihilation, in a medium possessed of inertia and mechanical properties, the "dialectric ether" of Faraday and Maxwell. An electron becomes a simple cavity in the ether, which behaves like a projectile moving through a perfect fluid, without a viscosity. On the sides of the projectile, a fluid cushion is formed, and behind it a zone of deep dead-water; the essential inertia will accrue from all the inertia of the wake thus created back of the moving mass. A part of the muzzle-energy will be expended in overcoming the inertia simultaneously with that of the moving body, but when the movement is once initiated, it will be perpetuated without resistance since the body will carry its wake with it. The electron cannot have any inherent inertia, but cannot be displaced without dragging with it the surrounding ether attracted to its lines of force, and its inertia will proceed from that of the ether, thus disturbed, which will originate an electro-magnetic wake. Matter is thus converted into a space in the ether, and the ether gains in substance what matter loses.

This conception is derived from the labors of Faraday, who brought into notice the importance of the medium in electric and

magnetic phenomena. The attention of physicists has been directed to the study of the magnetic and electric fields, in the interior of which the energy is concentrated, matter serving only as a support for such fields. Instead, however, of conceiving these as real, and existing in an independent fashion, physicists have claimed to explain them by the mechanical condition of a hypothetical medium—the ether—electric energy being only the potential energy of its deformations, and magnetic energy, the kinetic energy of its displacements. The ether becomes the active medium, in which the transportation and transformation of energy are controlled by the equations of the magnetic fields due to Maxwell and Hertz, and thus, little by little, matter is emptied of its physical content in proportion as the ether becomes the sole real substance.

Going further, Gustave Le Bon has written the epic of the metamorphosis of matter. Let us imagine that the electrons—into which are finally disintegrated the molecular structures that constitute substances—may be created by vortexes in the interior of a universal fluid, analogous to the ether of Lord Kelvin. Instead of considering these vortexes as indestructible, conformably to the hydrodynamic equations of Cauchy and Helmoltz, let us assume, offhand, that they diminish in the extent of the fluid, as occurs with a waterspout, passing into ripples by gradual retardation of their velocity. The rotatory energy of the electron will be transformed into radiant energy, which will be lost in infinity, as it sweeps through all space. Thus, matter is segregated into electrons, which are themselves resolved into etherial undulations, so that there is a definite loss of matter, without a recovery of energy. For the principle of universal constancy, which the Greek philosophers put as the basis of natural philosophy, and is quite comprehensible, "Nothing is created; nothing is destroyed," should be substituted the dictum, "Nothing is created; everything is destroyed." The universe moves towards a complete bankruptcy, and the ether, which has been proclaimed as the matrix of the worlds, becomes their tomb. Le Bon is a Zarathustra, who, in elegant phrases, announces the "Twilight of the Creation of the Gods" after their death.

These conceptions encounter insuperable difficulties. The ether is given contradictory mechanical properties, and the attempts at explanation of electro-magnetic phenomena based on these assumptions are wrecked. If the ether exists, Fizeau's experiment shows

that it cannot be wholly controlled by matter; that it cannot be partially so controlled is demonstrated by the principle of action and reaction; the principle of relativity implies that it cannot be immovable. More difficult of formulation than Proteus, there is nothing more to be done than to prepare a report of its bankruptcy. To these vagaries, the theory of Le Bon adds new difficulties. The equations of Cauchy and Helmholtz show that a vortex developed in a homogeneous and imcompressible, perfect fluid is everlasting. The electronic theory of radiation binds the appearance of these to the electrons, which play the part of agents, in presence, in the transformation of the different forms of energy into radiations, and which allow these transformations, their own conditions being unaltered, as enzymes in catalysis. Their disappearance will, therefore, involve exactly that of the radiation in which one would want to cause them to be annihilated. Finally, if we abandon the principle of invariance, as laid down by the Greek philosophers, there is the possibility that science itself will be put in question. Science, being a search for the laws of nature, that is, the invariants of universal evolution, will be no more of value in a primary approximation than for systems in which the disintregation of matter and the radiation of energy to infinity will be practically insignificant. The metaphysical problem will appear as to why the universe if it has had no beginning, has not been annihilated milleniums ago in an ether "immobile and dormant."

To dismiss the theory of the ether will lead us to an entirely different view, that of the "Materialization of Energy." Energy will emerge from the domain of the "imponderable," to take on substance, like spirits assembled from the Elysian Fields when Ulysses appeared on the Cimmerian shore. It becomes possessed of inertia, weight and structure, and manifests itself under two forms, one by reason of long ascription, termed *matter*, the other, *radiation*.

Matter is characterized by its structure, that is to say, by the number and nature of the electrons, and perhaps, positive nuclei, which constitute it, as well as by its property of being moved by active velocities, in correspondence to a system of reference, from zero to that of the velocity of light.

As Ostwald has said, we know it only by its energetic effects—the electric field of the electron at rest; the magnetic field of the electron in motion, the gravity field of molecular structures formed

by the aggregations of the electrons, and the kinetic actions due to their *vis viva*. The electron is shown to be a particle of negative electricity, so that matter is, in truth, a form energy, largely accumulated in a very circumscribed area in space. It does not lose for all that as it does in the theory noted above—the reality and substantial nature—that external perception and ordinary sense have mutually attributed to it up to the present, inasmuch as the energy which is its essence is possessed of mass, weight and structure.

Radiation is a form of energy, which is no longer held to be propagated by a sort of waves throughout a hypothetical medium, but as sent forth in the form of discrete particles through empty space, with the uniform velocity of light. It also is possessed of inertia, gravity and structure. The analogy of its basic properties with those of matter, enables us to explain its action on the latter. A luminous radiation, representing a certain amount of movement, is strictly comparable to a material projectile. For this reason, by virtue of the law of action and reaction, it exerts a repulsion on the material source that projects it, and propulsion on the material obstacle that absorbs it. The ancient metaphysical problem of the action of the imponderable on the ponderable, of force on matter, which is postulated under the most recent and most urgent form, that of the pressure of radiant energy, disappears at once, being, in fact, a pseudo-problem.

The distinction between matter and radiation should not at any time conceal an antagonism, in some respects, profound; that of the electromagnetic field and the gravitational field. This antagonism can be expressed still in the older terms "energy" and "space." Radiation, caused by alternating electromagnetic perturbations, matter, the elementary particles of which are nothing but condensation of the electromagnetic field, appear equally as simple modes of the latter. In contrast, this latter seems not reducible to the gravimetric field which is identified as "Einstein space." A point in space can be conceived independently of an electromagnetic field, but not independently of a gravitational field. In truth, outside of the latter, there can be no measurement, no luminous radiation, no possibility of the existence of the standards of measure and time, and, consequently, no apprehendable physical reality. Though connected by a causal relation, the electromagnetic and the gravimetric fields are logically separate.

Does such a statement lead us to the view that this opposition is absolute, that is, that we can never comprise energy and space, the electromagnetic and the gravitational fields in a single representative scheme? H. Weyl, a mathematician of ability, has advanced reasons for thinking otherwise, and has written an essay containing a notable synthesis in this view. This statement of theory has not met the approval of Einstein. Its exposition would exceed the limits of this work, but it deserves to be mentioned.

THE OCEAN OF VITALITY AND RESERVOIR OF LIFE.[1]

John Uri Lloyd.

"Lo, the poor Indian, whose untutored mind,
Sees God in the wilderness, and hears him in the wind."

Listen. Be you of intellect profound, or of research into life's mysteries deep. To you, be you young or be you old, as years are counted, if you will but think, the above motto surely must appeal.

Come! Let us seek a library where may be found records carrying slivers of knowledge that men in the passing along have put into print, men of scientific conspicuity, men of educational opportunity, men primitive but yet observant. Let us open these volumes, consider their contents. Among them we find a neglected publication, written by an empiricist who lived in touch with Nature. Almost is he fully described by the motto that heads this article.[2] Turn to Chapter I, the very beginning of his Introduction. Let us quote:

"An Indian, it is storied, when asked what he thought was the reason of the ebbing and flowing of the tide, made answer: 'You know there is a great deal of odds between a big creature and a little one; a horse draws his breath a great deal slower than a mouse; the world is a *big creature*—he draws his breath only twice in the day and night; that makes the tide.' "

[1] Fragment of a lecture connected with (introducing) "Vegetation," delivered in the Eclectic Medical Institute, Cincinnati, about 1879. Permission to publish in a Medical Journal reserved.

[2] "The Indian Doctor's Dispensatory, being Father Smith's Advice Respecting Diseases and Their Cure." By Peter Smith of the Miami Country, Cincinnati, 1812. (This is the first book under the name Dispensatory, printed in America west of the Alleghenies.)

The Story, the Great Deep.—Comes not from out the "Great Deep" that breathes twice each day,—the material we may as a blanket term, call Life Pabulum, be it organized or unorganized? That substance, be it earth or stone, be it hot or cold, which, seemingly dead and devoid of self, needs but the touch of life to become a vitalized entity? Go to the hills about, study their frames,—behold we not therein the skeletons of fish and shell, of trilobite or creeping thing evidence of old ocean's handiwork? Seek the desert and the canyon's cliff,—study the pages left in dust and strata,—comes not to mind-view a bygone time when this dry dust and these lofty walls were a part of ocean's floor? Turn to the petrifications of gigantic trees that, among ocean's debris, lie scattered over plains, hills and valleys, amid the western wilds,—Do not these, in their broken selves and surroundings, indicate that perhaps not once alone but repeatedly, they may have been sunken below ocean's wave, to be again uplifted? Behold the volcanic peak, speaks it not in its cloud clasp, ocean's kinship? Even though it be remote from the sea and inactive since all time, as men count time, or be it today a fire-cone center or a new-made island, perhaps the seed of a continent to be, feeds not old ocean its fires, is not the cloud mantle but a touch of her wealth? Claims she not that mountain as her own?

Consider the story told by the fossil shells that voiceless bespread all Central Western America, and elsewhere the world throughout. Imbedded are they in the hill's crest, as well as in the soil of the sunken valley. Go where you will, study the record of it all, earth and stone, mineral and salt. Be they as unorganized by the touch of what we call life as are the sands of the shore; or be they fossil relics, once vitalized,—Claims not each, relationship to mighty Ocean, in language mute? Say they not, as clearly as do the fossil teeth of shark in Florida's sands, "Once I was beneath the ocean's wave—a part was I once of Old Ocean's realm?"

Life.—What is this thing men call life? This evanescent something that, catching air, earth, water and sunshine, blends them into creatures new and strange? Whence does it come, where does it go? Suffices it to say that life alone is not an entity, that it, of all else, is but a transient nothing. That air and earth, elements and all materials ponderable, are mutable in

form, but yet eternal in the ultimate, whilst life without a home is as a vacuum but yet vitalizes one and all "living" things; only speakable as a word, but no more self-existent than the vibration of a leaf. A conception that exists not but makes all else alive; comes it from out of nothing, a nothing in itself to vitalize dead matter and next, perish forever? Suffice it to say that light and heat, electricity, force and energy, in their various modifications, pass one into the other, no more destructible than are objects of gross weight, but yet that the subtle thing, Life, imponderable, known only by its mighty influence, is but an ideality? A satisfactory definition to him who meditates in book-lore only is that life is "the state of being, which begins with generation, and ends with death."—*Webster.*

Accept such as this for want of data in the ultimate, and life stands as a marvelously evanescent conception; neither constitutional matter nor force modification is it, neither weighable nor measurable, neither warm nor cold. Unreachable by aught than observation of effects, observable only in its action, conceivable only by utilization of life-made intellect which in denying *life* a place in force fields condemns its own self into the realms of vacuity be it of the past, the passing along, or the ending.

Take this definition and we find that "life" is as hypothetical as is "spirit," as everlasting as is a theoretical soul entity, and yet as transient as are the fleeting moments that have neither substance nor energy in form nor conception; that life-bred, mind-creations come and go "as the moments pass," but cannot be "corrolated" with aught known as matter and force?

And yet, is it not true that *conditions* favoring imponderable life phenomena can be studied as can those governing the transmigrations of the material atom? Do we not know that heat and light, electrical conditions and material surroundings, are a part of life's necessity? But is it not also true that, although neither one nor all are *life,* neither one nor all if devoid of "vitality" can be utilized by man to make a living creature? The chemist has never caught it, the microscopist has never seen it, the mathematician has never calculated its size or shape, the theorist pauses.

Pass now the speculative field in which speculation is inadequate where outreaches beyond materialistic fact overwhelm him who in finite mind, presumes to dare infinity. Bold must be the

man, who creeping on a speck that floats in immeasurable expanse, ventures even to ask how beginningless time commences and passes into time's everlastingness. How nothingness itself sprung into existence, how void of something came into space, how, from out that spaceless hypothetical vacuum *nothing,* matter was created? Audacious must be the human who presumes to ask himself how a Creator of it all could have been himself created before creation began, how came the initial God of all—who of all mankind, in the face of infinity, ventures even to ask, what is the atom's origin, be it what it may, much less what is "life's origin"? Who of modern or ancient savants ventures to speculate about the outreaches that in microscopic depths lie beyond the infinitely little, who is it that bounds the overwhelming, unthinkable depths that lie in space beyond the telescopic great?

And yet, this we know, old ocean, a reservoir of activity, beats every shore, she laps the sunshine and her waves roll in and back again, her vapors cloud the earth, showering life-giving rains, and reservoirs of snow, her tentacles as rills and rivers thread the land. Out of the riches that lie in her bosom and the moisture of the breath with which she envelopes and nourishes all that lives, come the endless forms of creeping and growing things. Is not her's "The Ocean of Vitality and Reservoir of Life"?

SAFEGUARDING THE GATEWAY TO PHARMACY.*

By Prof. J. W. Sturmer.

"All men are created equal," wrote Thomas Jefferson in the document which sets forth the fundamental tenets of Americanism. And so they are, in the sense in which the phrase is used here. But certainly far from equal in physical power, mental capacity, or in those psycho-physical or psycho-physiological characteristics which make for courage, energy, perseverance and the determination to carry a task to a satisfactory conclusion. Equal in the sense that no man in America is born a serf and another his master, but not equal in the capacity for development and for the grasping of opportunity. Not equal—we may say further—in ability to distinguish right from wrong,

*Read at the 1921 Meeting of the Pennsylvania Pharmaceutical Association.

good from bad, or what is wise from what is foolish. "All sorts and conditions of men" there are, and nothing is more firmly established than that each individual has an individuality.

Yet schools and colleges must deal with boys and girls, and men and women, in groups. Hence no system of education, general or special, fundamental or vocational, can be expected to reach perfection, for the human equation in the student-body is the ever-present disturbing factor.

When our draft boards disclosed the percentage of physically unfit, the information was found startling. And when the army published the results of its mentality tests, these findings were no less disquieting. Yet there is no reason to doubt that the mental disparity disclosed has existed in the human race for centuries.

To be sure, Uncle Sam's enlisted men showed a wider range of mental capacity than could be found in the classes of any school. Indeed, no school could operate, no curriculum could be devised, with a student body representing such extraordinary inequalities.

As regards colleges, their curricula and teaching methods are based upon the assumption that they must deal with selected groups. In the terms of the army groupings, college classes are made up of students whose mental capacity places them in the groups A, B and C; those who would rank as D and E having been sifted out by the elimination process of preliminary education.

In other words, elementary and secondary education not only prepares for college, but also excludes those who are not fitted to profit by college training. It is with this fact in mind that so much stress is now placed upon entrance requirements for pharmacy. It should be remembered that we are generalizing, and that we cannot be turned aside by exceptions, which disappear from view when we consider humanity in mass. And by and large, it is unquestionably true that the quality of the personnel of pharmacy will depend as much upon the entrance requirements exacted by the colleges as upon any other factor.

But, some may say, having in mind the early periods of pharmaceutical education, did not the colleges turn out excellent men prior to the high school entrance requirement? Yes. But let us see how conditions differed. At that time college training

was not a legal requirement, and college classes were made up, speaking generally, of students who were there because they wanted to be there. And for those who entered pharmacy through other routes, the colleges had no responsibility. The apprentice system was then in vogue, and only the most promising apprentices were encouraged to go to college. So the apprentice system very effectively reinforced the schools in eliminating those who because of incapacity, lack of energy, lack of perseverance, or of adaptability for the work, or because of moral deficiencies, were unfit for college. This is no argument for the re-establishing of the old order of things, and certainly no argument against the college pre-requisite clause of the pharmacy law, which has proven an inestimable benefit to the public. It is simply a statement of facts and an explanation why certain readjustments became necessary.

Under the present conditions with the apprentice system only partially operative, and legal regulations compelling all who wish to qualify as pharmacists to do so through the college, we can readily see that the entrance requirements now have added significance, and are of greater importance, for now we must depend upon the high schools almost wholly for the sifting process, which will dispose of those who are unsuited for college. A peculiar aspect of the problem is brought to view when we compare the entrance requirements for medicine, engineering, dentistry, and the other professions with those now operative for pharmacy. For all other professions, and indeed for all other courses of collegiate grade, a complete four-year high school course is the admission requirement. These professions, therefore, get the benefit of all the selection which secondary education is capable of effecting. As long as pharmacy has an admission requirement lower than this, pharmacy colleges are bound to get more than their share of incapable students, for to the high school flunks, no other professional course is available. This is why the pharmacy colleges are glad to speed the day when the full four-year high school requirement will be uniformly enforced.

To be sure, we have had men who registered under lower requirements and of whom we may be justly proud. But our teaching problems have been made more complicated and our percentage of failures has been increased, because of the pres-

ence in the classes of students whose preparation was not adequate, and who would have been eliminated had the sifting process of the full high school course been brought into operation. Remember, we are discussing general principles and that we are quite willing to concede that some who fail to complete high school are forced out by economic pressure, and are not eliminated because they are unfit. However, the experience of other professions has proven that the most energetic and determined of these do eventually qualify, though it takes them longer to reach their goal.

Suppose then, in 1923, all the pharmacy colleges of the Conference make operative the four-year high school entrance requirement. Will this insure a satisfactory personnel for pharmacy? I wish we could answer yes, and say yes without qualification. But we cannot. There is yet one other matter to consider. It is this: Education is a selective process fairly successful in picking men and women who can *do,* and is helpful even in selecting those who will *do right;* but it cannot be depended upon as an infallible procedure which will exclude all the unworthy. Pharmacy is a calling involving peculiar responsibility—it is a public trust—and should be limited to men and women who may be trusted fully and unreservedly. It devolves upon pharmacy to guard and to keep pure the modern Pool of Bethesda, which through the instrumentality of science has been provided for suffering humanity. Therefore, we must insure the quality of the personnel of pharmacy.

In the archives of the older colleges may be found the certificates of character of the early students. These certificates were provided by the preceptors, and they disclose full knowledge of the candidate's fitness, mentally and morally, for his calling. No doubt these old documents explain why, despite the absence of definite entrance requirements, the graduates of the early classes acquitted themselves so well. Cannot we re-establish, so far as this is practicable, the old-time *character standards* as an entrance requirement? We have gone as far as we can in employing preliminary education to pick our students. What remains still to be done must be done by the pharmacists out of whose stores our candidates for admission come—and by the colleges, in establishing character standards for admission. Will the proprietors of pharmacies share with the colleges the responsibility

of guarding the gateway so that only the fit may enter pharmacy? We feel they will; for all in pharmacy must realize the necessity of maintaining high character standards for the personnel of pharmacy. Pharmacy is as great and as good as the men in it. No greater—no better.

KAPOK OIL.*

W. H. Dickhart and H. P. Trevithick.

Kapok oil is an oil which is made from seeds quite similar to cottonseed and which resembles cotton oil in many particulars, especially in that it gives a Halphen reaction which is just as strong and positive as that of cotton oil. Importations of the oil are quite rare.

The seeds are black, the size of peas, and have a white kernel. They grind easily and being free from lint are very easy to crush in a cottonseed plant. However, so far as we know, but one lot has been crushed in such a plant.

Lewkowitch gives widely varying figures for the characteristics of the oil, so that when we received a sample sometime since, we took the opportunity of determining some of the values for ourselves.

The oil as received was fairly clear, of a brownish color, and showed the following results upon analysis:

Moisture	0.45%
Insoluble Impurities	0.36%
Specific Gravity	0.9221
Iodine Value (Wijs)	94.9
Saponification Value	194.5
Index of Refraction at 20° C	1.4710
Unsaponifiable Matter	0.66%
Free Fatty Acids	12.13%
Refining Loss	35.0%
Color of Refined Oil—35 yellow	7.0 red
Titre of Refined Oil —° C.	28.1°
" " Soapstock —° C.	30.2°

Halphen Test—Positive, strong, immediate.

The Halphen color appeared just as fast as if the sample was cottonseed oil, showing a reddish tinge before the carbon bi-sulphide had left the oil.

*New York Produce Exchange.

ABSTRACTED AND REPRINTED ARTICLES

PHYSICS A HUNDRED YEARS AGO.* †

Macdonald Professor of Physics, McGill University, Montreal, Canada.
Corresponding Member and Associate Editor.

By A. S. Eve, C. B. E., D. Sc., F. R. S.

A century ago science had recently lost three eminent men who had notably advanced our knowledge of electricity, dynamics and heat, Cavendish (1731-1815), Rumford (1753-1814), Watt (1736-1819).

The steam engine had appeared and was used for pumping mines, for locomotives and for the propulsion of ships; the notable discovery had been made, to quote the contemporary words of John Herschel, "A man's daily labor is about four pounds of coal." "Two pounds of coal would raise a strong man from the valley of Chamounix to the top of Mt. Blanc." "You can raise seventy million pounds weight a foot high by a bushel of coals."[1]

There had just begun that industrial revolution due to the use of coal and iron, which, for better or worse, has in a century transformed the world.

Every age regards its progress with a wholesome and justifiable pride. The achievements of preceding generations are dimmed in lustre by familiarity. The imagination is too feeble to form an adequate conception of the marvels awaiting discovery, ready to fall like ripe plums into the laps of successors. On the other hand, recent discovery always stands out with a delightful and refreshing vividness.

Now a hundred years ago people were thoroughly pleased with their discoveries, no less than we are today. It is sufficient to mention such successive discoveries as the spinning jenny (1768), spinning frame (1769), cotton gin (1792); the discovery of the planet Uranus (1780), the first air balloon (1783), and vaccination (1796).

*Address at the Centenary Reunion of McGill University.

†Reprinted from the *Journ. of the Frank. Inst.*

[1] The actual work done by a bushel of coals used in a steam engine was called its *duty*, a useful term.

Thanks to Newton and others, it was a just claim, in 1821, that more scientific progress had been made in the preceding two hundred years than in the whole previous history of mankind.

It is curious to read moreover the lamentations by Thomas Young on the enormous amount of scientific literature and the great variety of publications, which rendered it difficult or impossible to keep abreast with scientific discovery. How seriously has this evil increased during the past hundred years, until we seem doomed to be buried under our own records! And this trouble must continually increase with time.

Mr. James McGill was an enlightened citizen of Montreal with an interest in literary and scientific progress. It requires but a small stretch of the imagination to conceive of our founder sitting under an elm tree on Burnside Farm by the side of that little brook, with its rustic bridge and lovers' walk, which flowed past the spot where the Macdonald Physics Building now stands. The valley of that brook is still visible in the back lane and tennis court. And indeed in spring time, the brook itself revives and floods our basement.

Imagine him seated there and reading the following fictitious letter supposed to have been written about a century ago by a friend of James McGill, an imaginary professor of natural philosophy at the famous University of Glasgow, giving an account of a visit to London and Paris, and describing to our founder what he saw which was new and interesting in the scientific field. It is a matter of regret to me that I cannot read this letter to you in the good Scots tongue.

From Professor Robin Angus,
The University of Glasgow,
(Undated).

To Mr. James McGill,
of Montreal.

Dear Mr. McGill,

I am now fortunate in writing to you to give my promised account of a long projected visit to London and to Paris, and my description of the progress of recent discovery in natural philosophy.

I left Glasgow on the first of June and the roads were in good condition so that we made a swift and agreeable journey. One day indeed we traveled 59 miles in 11¾ hours, including time for baits!

On my arrival at London I quickly went to the Royal Institution and called on Dr. Thomas Young. I was fortunate enough to hear one of the 93 lectures which he is giving on natural philosophy. These lectures are shortly to be published as a book, a copy of which I will send you. His lectures were well illustrated by skilful experiments.

You are aware that Sir Isaac Newton suggested that light consisted of little bodies of corpuscles shot from the source of light traveling "with an eel-like motion" along straight lines. Now Dr. T. Young will have none of this theory, but he agrees with Huyghens that light travels with wave motion in some subtle and all pervading medium which is called æther. Huyghens thought that light consisted of waves with a motion of the æther to and fro in the direction in which light traveled, but Doctor Young points out, as did Newton, that light may be "one-sided" or polarized, so that it is essential to believe that the vibrations are transverse or perpendicular to that direction in which light moves. As indeed the French philosophers have very clearly proved.

Doctor Young has a large trough with a glass base, filled with water, illuminated beneath; and with a large mirror he projects upon a white screen the waves which are made upon the water by one or more pointers fastened to vibratory rods. In this manner he illustrates very clearly what is called the interference of light, well enough known to Newton, but a stumbling block to his corpuscular theory.

At the Royal Institution I met also with Sir Humphrey Davy, who has saved countless lives of miners by his safety lamp, where the flame is surrounded by fine wire-screen, preventing premature explosion.

The great Corsican ogre, Napoleon, scourge of the world, is newly dead. Yet in fairness it must be stated that he proved a good friend to science. In the midst of the war between England and France he gave, in spite of strong opposition, a great scientific prize to an Englishman, Davy, for his discovery of potassium and of sodium by electric separation. He caused a galaxy of scientific men to gather at Paris, and encouraged them in their work by every means at his disposal. Napoleon was a man who certainly knew that in science, too, "As a man sows, so shall he reap."

I met at the Royal Institution a young assistant of Davy's named Faraday who was full of insight and enthusiasm so that he promises to go far. He was greatly interested in electrical experiments.

You are familiar with electrical machines and Leyden jars, lightning rods and Franklin's experiment with the kite, and how he obtained electricity from the clouds. All these are well described in a little book by Doctor Priestly [2] which I sent you last year. But, as the Hon. Mr. Cavendish wrote, "It must be confessed that the whole science of electricity is yet in a very imperfect state"; or to quote my friend Doctor Young (p. 507), "The phenomena of electricity are as amusing and popular in their external form as they are intricate and abstruse in their intimate nature."

Suddenly there has come from Denmark a great burst of light, which we owe to Hans Christian Oersted. This illustrious man was born in 1777, and after passing with honors at school he received *free* residence and a small scholarship awarded to needy students.[3] After a distinguished career at Elers College he received a Cappel Traveling Fellowship which enabled him to visit the leading scientific men in Germany and France to his great benefit as it now proves to ours.

This plan of helping able students to secure a good university education and to visit other countries in order to appreciate scientific progress, has much to commend it to other countries and to all universities.

Many philosophers have endeavored to deflect a magnet with electricity, using an electrical machine with open circuit. Now Oersted was lecturing to his advanced students and he discovered, his class being there and then assembled, that with an electric battery and a closed circuit he could cause a current of electricity to deflect a magnet. Not when the wire is perpendicular to the needle, but when parallel. This influence will pass through wood and water and mercury and metal plates, excepting iron, so that the influence of the electric current on a magnetic pole is as it were in circles around the wire. Already Schweigger, at Halle, has invented a measurer of electric current called the Astatic galvanometer, where

[2] "A Familiar Guide to the Study of Electricity," 4th Ed., 1786 (J. Johnson, London.)

[3] *Nature*, p. 492, June 16, 1921.

two equal magnetic needles pointing opposite ways have been deflected by a current passing in a coil of wire round one needle, a most sensitive arrangement.

Davy, using the great battery of 2000 cells of zinc and copper at the Royal Institution, has passed an arc between two carbons giving a most brilliant light. Now this arc he has deflected with a magnet, showing that as a current in a circuit will deflect a magnet so will the magnet deflect the circuit if and when a current passes in it. Here then we have another example of the third law of Newton that "action and reaction are equal and contrary." Nay! Oersted himself hung up by a fine wire a small battery and coil and deflected it with a magnet. Hence we now have a new branch of science, my dear Mr. McGill, which we may call electrodynamics or electromagnetics. The great M. M. Ampère at Paris has made vast strides in this new subject.

And indeed I must pass over much that I would wish to tell you that I saw and heard in London, and proceed with my visit to Paris, which I reached safely after a troubled crossing over the Channel.

In spite of the recent wars, most cordial relations have speedily returned between scientific men of all countries.

I have met M. Ampère who, stimulated by Oersted's discovery, has extended it and proved that "two parallel and like-directed currents attract each other, while two parallel currents of opposite directions repel each other."

It may be truly said that "the theory and experiment (of electric currents) seem as if they had leaped full-grown and full-armed from the brain of the 'Newton of Electricity.' The theory is perfect in form and unassailable in accuracy, and it is summed up in a formula from which all the phenomena may be deduced and which must always remain the fundamental formula of electrodynamics." [4]

But I must pass on, my dear Mr. McGill, to other branches of natural philosophy. I must name the illustrious M. Chladni, whom they call "the Father of Acoustics." Him Napoleon summoned to show his experiments on sound and gave a grant of money towards the publication of his book. Galilei first experimented with dust on vibrating metal plates struck by a chisel, but Chladni made great

[4] Maxwell.

improvements by using lycopodium dust with sand. He separated thus the quiescent from the turbulent regions, for as Farady has explained, the light lycopodium dust is caught in the whirlwinds of air and finally comes to rest below them, while the heavier sand is driven to the nodes. I have been informed that in the recent wars sand has been placed on a drum and the direction of underground mining has been found by the displacement of the sand on the top of the drum set vibrating by the distant blows on the ground of the picks of the enemy. An ingenious application of Chladni's figures!

Most interesting of all are the speculations about light founded on the most ingenious experiments carried out by Fresnel and Arago. They experiment with "one-sided" or polarized light and secure interference between two rays from the same source polarized in the same plane, which cannot be done when the rays are polarized at right angles. This is strong evidence for the wave theory, but a challenge was given that a small round body like a coin should have a bright spot in the center of its shadow from a small bright source of light. In truth, and it should! And the difficult experiment was triumphantly carried out by M. Fresnel!

Beautiful and interesting experiments have also been carried out by M. Malus on the polarization of light, and splendid color effects have been achieved with the interference of polarized light passing through crystals of mica, gypsum, or quartz.

The simplest interference experiment is to pass light through a slit and hence through two slits close together. On a screen behind you can perceive bright and dark bands alternating which prove that two lights can make darkness, which seems impossible with material things, but is readily explained with waves, for we have all seen, on a lake or pond, crests and troughs of waves cancel one another.

There is great encouragement given to science in these days. Thus the famous Euler received a grant of £20,000 in the last century, and the British Government offered a prize of £20,000 for finding the longitude at sea within thirty miles.

Space has not permitted me to write of Fourier, a great mathematician who has established most fundamental principles of the flow of heat. His work, "Théorie de la Chaleur," has in his own lifetime passed into a classic.

But what shall I say of Laplace, author of "Mécanique Céleste," now seventy years old, comparable only with Newton, who has been honored by all political parties in the turbulent periods passed by France in his long life. A man more admired than loved perchance! Laplace has advanced the theory of tides, explained the origin of the sun and planets from a nebula to its present state, and proved that all bodies of the solar system are stable, and may have been so for periods of vast antiquity.

In the spectrum of the sun, Wollaston (1802) and Fraunhofer (1815) have found a very great number of dark lines which await explanation from succeeding generations. Here indeed we have a great mystery!

But I fear, dear sir, that my letter has far outstripped your patience. Your friends in Glasgow and in Scotland learn with pleasure and interest your scheme for founding a College for the Advancement of Learning in Montreal. Judging from what I have seen in Scotland, in England and in France such an institution may bring lasting lustre to your name, and yield priceless fruit throughout succeeding ages.

Believe me, honored sir,

Your most respectful servant,

ROB ANGUS.

It must be admitted that historically the above letter will be found wanting, for it purports to be written in 1821, by a "fake" professor of Glasgow University, whereas we all know that our founder died in 1813, eight years before McGill received its charter in 1821. I am assured, however, by my colleague, Prof. Cyrus Macmillan, that otherwise my conception of such a letter is a sound one, and that James McGill was truly interested in science as well as letters. He was himself a student or at least a matriculant of Glasgow University, a fact which explains so much. You will recall that he specially enjoined in his will that there should be a Professor of Natural Philosophy, until such time as there should be three chairs established in mathematics, natural philosophy and astronomy.

Today McGill has many professors of physics, a subject now taught to all faculties. McGill has also several professors of mathematics, but no astronomer, although he whom we might ven-

erate as our second founder, I name Sir William Macdonald, donated a splendid region on the summit of Westmount for an observatory, the land being still available, although we cannot hope for "good seeing" within the confines of a city yearly growing blacker with factory and engine smoke, largely preventable and unnecessary.

As for the information conveyed in the fictitious letter, it is gathered mainly from contemporary sources, and the lectures by Dr. Thomas Young, afterward published as a Treatise on Natural Philosophy, are a great mine of information. But a more valuable source is Mrs. Kirstine Meyer's recent essay [5] on the Life of Oersted. For in 1801 Oersted went to Weimar, Berlin, Gottingen and Paris; he saw Ritter's electrical experiments and the very first storage battery, copper plates with damp cardboard between, which retained a charge for some time after it was connected to a battery, capable also of generating a current after being charged.

In 1812 and '13 Oersted again visited Berlin and Paris, and from autumn, 1822, to the summer of 1823 he visited Germany, France and England, although he was full professor of natural philosophy at Copenhagen at the time. I mention this because we see here in the same man the great advantages of three notable institutions or arrangements which I wish to advocate ardently for Canada and elsewhere. For in the case of Oersted we see an able but needy student obtaining free board and residence and a scholarship as well, relieving him of money embarrassments and securing him a sound and liberal education. Secondly, we find him with a traveling fellowship, which enabled him to appreciate the work and progress of many scientific centres. Lastly, we find him with a sabbatical year, relieved from the burden of teaching and academic affairs, and given leisure to think and to investigate. The scholarship, the traveling fellowship, the sabbatical year were all fruitful. As a result Oersted founded electrodynamics, for he proved that a coil of wire with a current round it was the equivalent of a magnet.

This fundamental result, developed by Ampère, Faraday, Maxwell, and many other co-workers, is the seed of the fruitful results or harvest which you see around you today. I refer to

[5] See *Nature,* June 16, 1921.

electric motors, lamps, dynamos, generators, electric irons, cookers, bells, toasters, cleaners, and no less to telephones and telegraphs.

We can rest assured that if you give due encouragement and assistance to your quite ablest boys at schools, and to students and professors at universities there are other and greater conquests of science of which we have little or no conception today, awaiting discovery and development, and that you must not hesitate to encourage pure research, at unpromising subjects even, rather than endeavor too much to secure industrial research on a commercial basis. The pioneer work is truly of the greater importance though less likely to secure the appreciation of manufacturers, of politicians, of practical men and of the public at large.

Here I must interpose a story. About fifteen years ago, one of my predecessors, Professor John Cox, gave a lecture in this theatre on the passage of electricity through rarefied gases combined with some wonderful experiments, all with the skill and eloquence of which he was and is still a master. Now Sir William Macdonald was present and he remarked afterward, "How beautiful and how useless!" Yet it is the study of those very phenomena which has led to most notable recent developments in radiology, for example the Coolidge tube, in long-distance and guided telephone, in wireless telephony and telegraphy, particularly by the use of the electronic valves.

But Sir William appears to have been himself a convert before his death. As donor to McGill of this Macdonald Physics Building, as founder of the two Macdonald chairs of physics, he was present at a lecture given by Sir Ernest Rutherford on some of his recent work on radioactivity, and after the lecture Sir William stated that "if all the money spent on the endowment of physics at McGill had produced no other result but Rutherford's work on radioactivity alone—the money would have been well spent!" That verdict you will all endorse, with a fervent hope that, although we can scarcely expect ever to rival that remarkable outburst at McGill, of a new branch of physics, we may not merely assist in the training of many thousands of young Canadians in the foundations of science, but also hand on the torch of original research and pioneer investigation in this place.

Oersted in 1822 and '23 was not very enthusiastic about German science. "Schweigger, at Halle, has brains, but is a reed

shaken with the wind. His experiments are not of much importance; Kastner, at Erlangen, writes thick volumes compiled with much toil but without all judgment. Yelin, at Munich, makes indifferent experiments and lies much." (Really, really, Yelin, this is too bad!) "But I have found much that was instructive with Fraunhofer, at Munich, so that I have been able to occupy myself with benefit there for about a fortnight." But he writes to his wife from Paris in February, 1823. "My stay here grows more and more interesting to me every day. The acquaintances I have made grow every day more cordial and intimate." He saw Biot, Fresnel, Poillet, Ampère, Arago, Fourier, Dulong and many others; such was the brilliant list of physicists there at work at Paris. He had long discussions with Ampère on his famous theory, still accepted, that magnetism consists of electric currents in the molecules—electron currents or oscillations as we should perhaps say today. Oersted adds, "On the 10th I was at Ampère's by appointment to see his experiments. He had invited not a few—he had three considerable galvanic apparatus ready; his instruments for showing his experiments are very complex; but what happened? Hardly any of his experiments succeeded. He is dreadfully confused and is equally unskilful as an experimenter and as a debater." This report is in strange contrast with the written records of Ampère which Maxwell has described as the work of the "Newton of Electricity," "perfect in form and unassailable in accuracy." Perhaps Ampère had had the best of an argument!

What then has been added in the last hundred years? Well, the answer to that question will depend on whether you are a so-called practical man or a theorist, whether you are most interested in the applications and practical achievements of physics or in the great principles and theories which underlie the theory and from which the practical applications necessarily arise.

The last hundred years have speeded up all human activities. It now takes days for matter to cross the Atlantic instead of weeks, as then; while messages are flashed across almost instantaneously. A hundred miles a day by coach or on horseback was a strenuous journey, a thousand miles a day by rail is today not formidable.

It has been argued with much force by R. A. Freeman in his "Social Decay and Regeneration" that mankind has suffered to a terrible extent by the great access of power which science has

suddenly placed in its hands, and it may well be doubted if society is yet fitted to receive fresh gifts of energy from the hands of science. Moral development and social organization has lagged behind scientific progress. Human nature is stable and ill fitted to adapt itself to changes of the magnitude and variety of the last three generations. The resultant in stability of modern conditions has shown itself to the greatest extent where the attempted assimilation has been most rapid and ill digested. Petrogard stands out as a prominent and inconceivable wreck, through the mirage of a prostrate Russia.

When we turn our attention to the intellectual achievement of physics we see a far more attractive picture. The last hundred years have seen the almost complete development of the science of electricity.

The great principle of the conservation of energy established by the insight of Joule, Kelvin, Helmholtz and others, stands together with the Second Law of Thermodynamics as the main prop of all physical conceptions. The isolation of the electron, the discovery of its properties, experiments with alpha and röntgen rays and immense developments in modern spectroscopy are illuminating a vivid conception of the structure of the atom. The present century is responsible for the new branch of physics, and in this very place Rutherford delved deep and built high in radioactivity, and we are all gathered together at a "veritable shrine," already venerated as such. We are passing to a new outlook where energy becomes dominant, so that not only does matter appear to be energy, but space, linked with time from which it is inseparable, is regarded as a continuum of energy mainly.

Most important of all is our revision of fundamental conceptions on a more comprehensive scale, in accord with the general scheme of the universe of which we are denizens, embraced in the fascinating and far-reaching Principle of Relativity.

Those only who have specialized in modern physics are familiar with the strange elusive problems embraced in the Quantum Theories of Energy.

An atomistic theory of matter is easy to conceive. A corpuscle of electricity, now called an electron, with well-marked properties, electric and magnetic, is not too obscure. But bundles of energy, or quanta, of magnitudes varying with and proportional to the frequency of the propulsive electromagnetic vibrations present formidable obstacles to the human intelligence, and yet some such entities pervade modern research, and are today most fruitful of actual philosophical progress.

I wonder what my successor, lecturing here one hundred years hence, will be saying about relativity and about quanta!

PASTEUR INSTITUTE SCIENTIST ANNOUNCES DISCOVERY OF PARASITIC ULTRAMICROBE FOE OF DISEASE-PRODUCING BACTERIA.*

The discovery of an ultramicrobe, which is a parasite on bacteria, and which may effect a cure of such diseases as dysentery, typhoid fever, hemorrhagic septicemia and bubonic plague has been announced by Dr. F. d'Herelle of the Pasteur Institute of Paris.

This powerful, minute organism will be able to play an important part in control of epidemics, according to Dr. d'Herelle. He has been able to make men, buffaloes and birds resistant to various diseases by simply introducing into them the ultramicrobe which had become accustomed to preying upon the particular bacterium that causes the disease.

All that would be necessary to stop an epidemic of some disease, typhoid for instance, would be to pour into the drinking water supply a very small amount of the proper strain of the ultramicrobe, Dr. d'Herelle declares. This would infect all of the people with the harmless bacteria-dissolving ultramicrobe which will protect them and prevent an epidemic. The ultramicrobe is tasteless and for all animals and man it is absolutely harmless, Dr. d'Herelle has found by experience.

This wonderful parasitic ultramicrobe has been named the "bacteriophage" or bacteria-eater.

*Reprinted from *Science Service*.

Brought to mind by this new discovery is Dean Swift's often-repeated quotation:

So naturalists observe a flea
Has smaller fleas that on him prey,
And these have smaller still to bite 'em,
And so proceed *ad inifinitum.*

Before announcing his work on the bacteriophage, Dr. d'Herelle has made exhaustive researches into the nature of this ultramicrobe which seems to hold the possibilities of revolutionizing ideas in medicine and biology.

Dr. d'Herelle explains the action of the bacteriophage as follows:

Take the case of *bacillus dysentery.* If a sample of the feces of the patient is taken mixed with bouillon, and then passed through a Chamberland filter, all of the microbes visible under the microscope will be retained in the fine pores of the porcelain filter and the filtrate or the liquid that passes through will be clear, will remain so indefinitely and is in appearance sterile. Suppose that a case of dysentery is followed during its course and that such a filtrate is prepared for each of the thirty days of the illness. If thirty tubes of bouillon cultures cloudy with dysentery bacilli were prepared, and if a drop out of each of the thirty filtrates prepared each day were added to the correspondingly numbered cultures, the following would be the result after twelve hours' incubation: Tubes 1 to 6, no change, cloudy with dysentery culture; tubes 7 to 18, perfectly clear; tubes 19 to 30, cloudy like the first six. A strange phenomenon has occurred in tubes 7 to 18 caused by the adding of the drop of filtrate. The bacilli have been dissolved. And at the same time that this dissolving began to take place the patient began to get well, and on the eighteenth day the cure was complete. The presence of the dissolving principle and the cure coincide. This has been found to be the case in other diseases, even those that are not intestinal in character.

And this principle that appears in the filtrate is thousands of times more powerful than the most energetic antiseptic known. A billionth part of a cubic centimeter of filtrate will dissolve a tubeful of dysentery bacilli And unlike a chemical, the bacteriophages will multiply themselves over and over again. A mere trace of the liquid

in the tube of dissolved bacilli will clear up another tube of culture, and if the process is continued a trace from the 999th tube will effectively cause the solution of the 1000th culture.

But in the dissolved culture of bacilli there can be seen no microbes, even if the most powerful optical means are employed. In fact, the bacteriophages are so extremely small that Dr. d'Herelle declares that without a doubt no human eye will ever be able to see them and determine their form even with the aid of any instruments that may be devised in the future. The volume of a bacteriophage is practically equal to that of a molecule of albumin. It is only by diluting a culture of bacteriophages many, many times, then adding a very small amount to a culture of bacilli and counting the spots where dissolving takes place, that the number of the bacteriophage in a given volume could be determined and that its role in nature could be discovered. By this method it was found that there are at least 2,500,000,000 bacteriophages per cubic centimeter.

There is only one species of bacteriophage able to acclimate itself to parasitism on a very large number of species of bacteria. A strain active against one bacteria can be trained in a test tube to become virulent toward a totally different one.

The bacteriophage is, of necessity, a parasite that is not able to develop except by penetrating into the interior of a living bacterium, secreting a bacterial solvent, and then reproducing itself by feeding on the dissolved microbe. It then sends forth the young bacteriophages to prey upon other bacteria.

The normal habitat of the bacteriophage is the intestine and it has been found in the intestinal tracts of healthy animals, both vertebrate and invertebrate. But it can be introduced in the blood as well and act there. Whether the bacteriophages protect the animal or not depends upon whether the strain present is virulent to the particular harmful and invading bacteria. In the case of the dysentery patient it took six days for the bacteriophages to become active. In fact, the history of a case of contagious disease is the reflection of the vicissitudes of the struggle engaged in within the animal or person by the pathogenic bacteria and the ultramicroscopic bacteriophages. But some bacteria, such as those that live in a healthy animal, are able to acquire an immunity to the bacteriophages, Dr. d'Herelle has found.

The bacteriophage is transmitted in the same way as the harm-

ful bacteria and an epidemic ends because all of the people have been infected by the bacteriophage and have become bacteriophage carriers.

Dr. d'Herelle declares that his discoveries are not antagonistic to the fact that the white corpuscles of the blood provide a defense against bacterial disease, but that the bacteriophages act in the case of animals without natural immunity or that acquired by disease or vaccination.

A monograph of the Pasteur Institute now in the process of printing will shortly be issued and will give a detailed scientific account of Dr. d'Herelle's researches on the bacteriophage.

BACTERIALLY TAINTED MONEY.*

During the earlier years of the development of the modern science of bacteriology, the hunt for harmful microbes was a popular laboratory pastime. The readily secured evidence of the widespread distribution of germs—perhaps it should be designated the omnipresence of bacteria—at first disturbed the peace of mind of many persons who now saw the possibilities of disease transmission awaiting them at every turn. Presently, however, it became clearer that not all microörganisms are baneful and that some are at least relatively innocuous; while the varied protective devices of the human organism against the microscopic invaders were being discovered in rapid succession, thus bringing the sense of relief that comes from the contemplation of our factors of safety.

The alleged danger of dirty money passed frequently from person to person in every day life has long furnished a subject for discussion by those who are accustomed to seek unanticipated calamities or who have in mind some project of a prophylactic nature. Not infrequently the latter are actuated by something more than purely philanthropic motives. There is no reason to believe, as might be expected if money in circulation were a menace to health, that those who handle it most frequently are peculiarly subject to disease. There are, of course, employments which represent vocational risks to the employees. Bank tellers and other money

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changers are not demonstrably exposed to unusual chances of infection, although the money which they handle is a medium received from all kinds of persons, often without regard to the possibility that it may be a carrier of infection.

There are scientific reasons why metallic coins may actually be destructive to bacteria. The latter are sensitive to small concentrations of the ions of some of the heavy metals. That such bactericidal action is actually exerted by coins seems likely from the studies of Ward and Tanner[1] at the University of Illinois, who found the indicators of pollution used in sanitary investigation entirely absent from coins in current use and examined by them. Thirty-seven of the strains of microörganisms isolated from the coins were spore formers, and probably spores are necessary before the organism may perpetuate itself for any considerable length of time on coins. This, the Illinois bacteriologists assume, may explain why none of the commonly accepted indicators of pollution were found. They are not spore-forming organisms, and consequently are destroyed by the action of the metals. In other words, the coins act to some extent as bactericides. Similar experiments reported in Great Britain, where the ability of coins to spread disease was tested by the use of common pathogenic microörganisms, disclosed that the life of the latter on the coins was very short. It was concluded that coins may be regarded as negligible factors in the transmission of disease.

Ward and Tanner have pointed out that postage stamps have somewhat the same relation to the public that money does, although their constitution is quite different from that of coins. Stamps are used but once and are not handled by so many individuals, although the adhesive applied to them might be a favorable abode for microörganisms for relatively long periods of time. Nevertheless, the menace is not regarded as a threatening one; and in an investigation conducted some years ago with refrence to the question here at issue, pathogenic bacteria were rarely found on stamps.[2]

[1] Charlotte B. Ward and F. W. Tanner, "Bacteria on Subsidiary Coins and Currency," *Am. J. M. Sc.* 162: 585 (Oct.) 1921.

[2] R. A. Keilty, and P. D. McMaster: *Med. Rec.* 90: 153 (July 22) 1916.

NOTES FROM A POPULAR LECTURE ON "PETROLEUM AND ITS PRODUCTS."

By Professor F. R. Stroup, at the Philadelphia College of Pharmacy and Science.

In the light of what is already known and what seems to be in the not very distant "offing," there is the possibility that the Man of the Future,—

Will live, in part at least, on fats made from fatty acids and glycerin made synthetically from petroleum products or fractions;

Will wear clothes dyed with petroleum dyes;

Will lubricate his alimentary tract with heavy petroleum fractions;

Will heal his wounds with petroleum base ointments;

Will not be afflicted with baldness because of the frequent and free use of crude petroleum;

Will walk and ride on roads made in part of petroleum asphalts;

Will ride long distances and have his freight and mail hauled on trains, boats, aeroplanes or dirigible balloons propelled by steam generated by aid of heat from burning petroleum, or by internal combustion engines using petroleum or some of its fractions;

Will travel shorter distances in cars propelled by the power developed by the explosion of mixtures of air and easily volatilized petroleum products; the

Running gears and cylinders lubricated with heavier petroleum products; the exposed portions of the cars

Painted with lampblack made from petroleum, rubbed up in drying oils made synthetically from petroleum and thinned out with petroleum substitutes for turpentine; the

Wheels shod with tires made of rubber made from isoprene made from petroleum;

Will undergo minor surgical operations under anesthesia produced by spraying the parts concerned with light petroleum fractions or easily volatilized synthetic derivatives of them;

Will undergo major operations under anesthesia produced by inhalation of some of these fractions;

Will live in houses heated by burning petroleum, or gas produced therefrom;

On streets lighted by arc lights, the arc of which plays between electrodes made from petroleum carbon;

Will drown his sorrows (when prohibition shall have become a reality) in gasoline "jags";

Will live a mosquitoless life, made possible by the free use of petroleum on all breeding places of the pest;

Will read books, magazines and newspapers printed with inks made of petroleum lampblack or dyes suspended or dissolved in suitable liquids of petroleum origin; with aid of

Lamps either burning petroleum products, or using electricity generated by petroleum propelled and lubricated machinery;

Will wear fine clothes and will sport diamond studded jewelry, purchased with money made in some phase of the petroleum industry; the

Diamonds made synthetically from petroleum carbon;

Will finally die because petroleum and its derivatives will have made his life so easy that his muscles and vital organs will not have had the exercise needed to make them useful or longer necessary;

Will have his mortal remains cremated in a petroleum fired retort; or

Will be consigned to the "bosom of Mother Earth" in a casket made of wood or other absorbent material so saturated with petroleum paraffin or petroleum asphalt as to make it practically free from decay; the final rites being performed

By an "oily-tongued" divine who will forget the vices of the "departed," and, remembering only his virtues, will give his spirit free passage over a petroleum lubricated road to that happy country where petroleum and its products and derivatives are not needed, even for fuel.

NEW REMEDIES

[This Journal will print in this department at regular intervals the several new remedies which are being legitimately introduced to the professions. It will endeavor to confine its attentions to preparations which are really new or are being reintroduced into the materia medica and which bear ethical ear-marks. The general terminology and text arrangement will follow a uniform or accepted style but where possible pharmacopœial arrangement will be attempted.

The presentation of a new remedy in this department does not necessarily vouch for its character, or its ethical qualities but an honest endeavor will be made to exclude articles that savor of quackery or charlatanism.]

AMYLZYME.—An extract containing all of the digestive enzymes of the fresh pancreas of the hog.

Actions and Uses.—Amylzyme has the power to digest starch and protein and to split fats. It is claimed that it is useful in digestive disturbances resulting from a deficiency of pancreatic secretion and that it hastens the digestion of starch.

Dosage.—From 0.13 to 0.26 gm. (2 to 4 grains), three times daily.

Amylzyme is sold only in capsules.

Manufactured by G. W. Carnrick Company, New York. U. S. Patent applied for. No U. S. trade-mark.

Amylzyme capsules, 2 grains.

Amylzyme is a pale yellowish white powder, having the characteristic odor of pancreatin and a faintly saline taste. It is hygroscopic and incompletely soluble in water, forming a turbid solution which is neutral or faintly acid to litmus. In starch digesting power, it is from three to four times more active than pancreatin U. S. P. IX, if tested by the U. S. P. method. According to the method adopted by the Council on Pharmacy and Chemistry (*Journ. of the Amer. Med. Assoc.,* July 11, 1908, p. 140) amylzyme converts from 110 to 130 times its weight of dry starch to a colorless end-point in ten minutes.

Bromipin 10 Per Cent.—Brominized Sesame Oil, 10 per cent. A bromine addition product of sesame oil, containing from 9.8 to 11.2 per cent. of bromine in organic combination.

Actions and Uses.—Bromipin, 10 per cent., acts like the inorganic bromides; but, since it yields its bromine more slowly, it is thought to have less tendency to produce brominism. The combination is not broken up in the stomach; but a portion of the bromine is split off as soon as the compound enters the intestine; the remaining compound is readily absorbed, and, as in the case of other fats, it is largely deposited in the tissues where it is slowly split up. Bromipin, 10 per cent. is said to be more lasting in its action than the bromides.

Dosage.—Four cc. (1 fluidrachm), which may be increased in cases of epilepsy to from 8 to 30 cc. (2 to 8 fluidrachms). It may be given in emulsion with peppermint water and syrup, or pure, flavored with oil of peppermint.

Marketed by Merck & Co., New York, under U. S. Patent 774,224 (issued November 8, 1904; expired), by license of Chemical Foundation, Inc., U. S. trade-mark 32,002.

Bromipin 10 per cent. is prepared by action of bromin chlorid to produce the required brominization.

Bromipin 10 per cent. is a yellow oily liquid, having an oleaginous taste.

To 1 cc. of bromipin 10 per cent. and 1 cc. of chloroform add a few drops of phenolphthalein solution. The addition of 0.3 cc. (1 drop) of half-normal sodium hydroxid produces a red color (*limit of acidity*).

Saponify about 3 gm. of Bromipin 10 per cent., accurately weighed, by boiling with 25 cc. of alcohol and 5 gm. of potassium hydroxide in a porcelain dish. Evaporate to dryness on a water bath and incinerate the residue over a gentle flame. Dissolve in water to make exactly 200 cc. and filter. Acidulate 50 cc. of the filtrate in a separator with diluted sulphuric acid; add 20 cc. of carbon tetrachloride and 5 cc. of freshly prepared chlorine water. Shake thoroughly and allow to separate. Repeat this until further additions of chlorine water do not cause the aqueous layer to become yellow. Draw off the carbon tetrachloride solution. Add 10 cc. of carbon tetrachloride, agitate and draw off the solution, uniting it with the

first carbon tetrachloride solution. Repeat the extraction with a further portion of 5 cc. of carbon tetrachloride. Pass the carbon tetrachloride solution through a dry filter into a flask and add potassium iodide solution. Shake thoroughly and titrate the free iodine with tenth-normal sodium thiosulphate. The amount of bromin found is not less than 9.8 per cent. nor more than 11.2 per cent.—(Through *Jour. of the Amer. Med. Assoc.*)

Butyn.—This is a name applied by The Abbott Laboratories, Chicago, to a new local anesthetic, proposed for use in place of cocaine in surface anesthesia in the eye and for anesthesia of other mucous membranes.

Butyn is para-aminobenzoyl-gammadinornalbutylaminoprophol sulphate. It is a white, hygroscopic solid, very soluble in water.

In the accompanying table the efficiency and toxicity of butyn with that of procaine and cocaine are compared.

On the normal human eye, a 0.5 per cent. solution of butyn is less efficient than a 1 per cent. solution of phenacaine (holocaine), but more efficient than a 1 per cent. solution of cocaine or a 1 per cent. solution of eucaine. Butyn solutions are nonirritant.

When injected hypodermically into albino rats, the toxicity of butyn is two and one-half times that of cocaine; but the fatal dose of butyn (injected intravenously into cats) is about equal to that of cocaine. Sublethal doses are more dangerous than those of cocaine.

COMPARATIVE EFFICIENCY AND TOXICITY OF BUTYN, PROCAINE AND COCAINE.

	Efficiency on Motor Nerves.	Efficiency on Sensory Nerve Trunks.	Efficiency on Rabbit's Cornea.	Efficiency on Frog's Skin.	Intra-dermal Wheal Test.	Toxicity for Perfused Turtle Heart.
Cocaine	1	1	1	1	1	1
Procaine	1	½	⅕	⅛	..	½
Butyn	8	2	1	2	2	1

—(Through the *Jour. of the Amer. Med. Assoc.*)

INCITAMIN OR FISCHER'S FLUID.—In a communication to the *Lancet,* October 29, 1921, page 933, Prof. J. J. Fischer, of Copenhagen, calls attention to a new remedy devised by him for the treatment of slowly healing sores. The preparation is composed of horse serum treated with trypsin and freed from coagulable substances, horse saliva, and carbolic acid (½ per cent.). It is made under his supervision by a firm in Copenhagen, and was originally called Fischer's fluid; more recently the name *Incitamin* has been given to it.

Incitamin is a colorless or slightly yellowish, not quite clear fluid; after standing for some time it deposits a sediment, but this does not affect its properties. It is non-poisonous when used according to directions. Incitamin is applied on a gauze compress, a little larger than the sore itself; this is covered with gutta-percha and kept in place by a dressing which is changed every morning and evening, or oftener if necessary. The preparation is contraindicated when there is idiosyncrasy to carbolic acid.

The use of incitamin is particularly indicated in the case of ulcers: in addition to its stimulant healing power it has a soothing effect which is appreciated by the patient. It is specially suited to ulcerations of a torpid, stagnant nature, such as ulcer of the leg. In syphilitic and tuberculous sores it has little effect. Prof. Fischer describes several cases in which incitamin was used with good effect. A little fuller information as to its composition would, however, be welcome.—(Through *The Prescriber.*)

TRYPARSAMIDE, A NEW CHEMO-THERAPY PRODUCT.—It is shown that tryparsamide, the sodium salt of *N*-phenylglycineamide-*p*-arsonic acid, possesses a marked trypanocidal activity in human trypanosomiasis caused by *Tr. gambiense.* Single doses of from 0.5 to 5.0 gm. produced a peripheral sterilization of lymph glands and blood in an average of 6 to 12 hours. The duration of the peripheral sterilization following single doses of 17 to 83 mg. per kilo ranged from 17 to 58 days in patients who ultimately showed a return of trypanosomes to the peripheral blood. In a number of patients, however, treated with single doses of 9 to 68 mg. per kilo, no such relapse was detected during an observation period of from

40 to 111 days. The drug is extremely soluble in water and may be administered intramuscularly as well as intravenously. The immediate trypanocidal action after intramuscular administration was as rapid as that following the intravenous route while the duration of peripheral sterilization was appreciably longer.

Relatively few repeated doses produced in advanced cases a marked and rapid diminution of the cells of the spinal fluid and were associated with definite improvement of mental and nervous symptoms. The occurrence of visual disturbances in certain advanced cases was the only untoward effect detected during the course of the work, and was apparently related to a too frequent administration of the drug. The condition was transitory in the majority of instances and resumption of treatment was not followed by a recurrence of this symptom.

The general beneficial effect of the drug was a noticeable feature of its action in both early and advanced cases as shown by the disappearance of subjective symptoms, by the return of the pulse and temperature to normal limits, by the pronounced improvement of the blood picture, and by well marked gains in weight.—(*Journ. of Exper. Medicine,* Supplement, Dec., 1921.)

SCIENTIFIC AND TECHNICAL ABSTRACTS

MICROCHEMICAL TESTS FOR SACCHARIN AND ITS SALTS. DENIGÈS.—(*Bull. Soc. Pharm. Bordeaux,* 1921, No. 2; *Ann. Chim. anal.,* 1921, 3, 273-275.)—The silver salt of saccharin is produced by treating on a microscope slide less than 1 mgrm. of a soluble salt of saccharin, such as the ammonium salt (*"sucramine"*) or the sodium salt ("sucrose"), with a drop of ammoniacal silver nitrate solution (3 per cent.). The crystals are of characteristic appearance, and serve for the microchemical identification of saccharin salts. Saccharin itself, which is almost insoluble in water, is first dissolved in a drop of ammonia, and the solution evaporated to dryness on the microscope slide. The crystals of saccharin obtained by the treatment of the sodium or ammonium salt with dilute sulphuric acid (10 per cent.), or with concentrated hydrochloric acid, are also of characteristic appearance. The sodium salt of saccharin may be detected by the formation of cubic crystals of sodium chloride produced on acidification with hydrochloric acid, whilst the ammonium salt yields prismatic crystals of hydrogen ammonium tartrate when treated with sodium hydrogen tartrate.—R. G. P.—(Through the *Analyst.*)

IDENTIFICATION OF OUABAIN AND STROPHANTHIN. A. RICAUD.—(J. *Pharm. Chim.,* 1921, [vii], 24, 161-166).—For the identification of these glucosides the following properties serve: Ouabain forms a pure white powder of nacreous appearance, and crystallizes in rectangular plates. It dissolves in 150 parts of water at 15° C., giving an absolutely colorless, transparent solution, which has a slight bitter taste, and gives no lasting froth when shaken. If a few crystals of resorcinol and then a few of ouabain are added to 4 to 5 cc. of concentrated hydrochloric acid in a test-tube, and the latter is heated to 60° to 70° C. in a water-bath for a few moments, no coloration appears. Strophanthin is usually a dirty white or very pale yellow powder, and is amorphous or crystallized in spangles, often arranged radially; 1 part dissolves in 40 to 43 parts of water at 15° C., giving a solution which is not absolutely colorless or

transparent, has a very marked bitter taste, and yields a persistent froth when shaken. When treated with hydrochloric acid and resorcinol, as described above, strophanthin gives a pink coloration.—T. H. P.—(Through the *Analyst*.)

ESTIMATION OF STARCH BY MEANS OF TAKA-DIASTASE. E. HORTON.—(*J. Agric. Science*, 1921, 11, 240-257.)—The results obtained in the estimation of starch in wheat by the use of taka-diastase varied according to the sample and quantity of the enzyme employed. These variations led to an extensive investigation into the action of this enzyme upon pure potato starch. In the method applied, with modifications, the starch, gelatinized in boiling water, was cooled to 38° C., when toluene and the enzyme were added, and the temperature maintained at 38° C. for sixteen to twenty-four hours. After the mixture had been heated to 100° C. for fifteen minutes, sodium fluoride was added, and the solution was cooled, treated with basic lead acetate solution, diluted to definite volume, and filtered. Excess of lead was then removed by the gradual addition of powered sodium carbonate, and, after filtration, the rotatory and reducing powers were determined, and the starch calculated from the dextrose and maltrose found. The purity of the starch employed was ascertained by the use of the same method with malt diastase instead of taka-diastase. The factors studied included the following: Source of enzyme, age of enzyme, age of *Aspergillus oryzæ* culture from which the enzyme was prepared, variation in amount of enzyme used, time of hydrolysis, addition of yeast extract or of malt diastase to the enzyme, and variation in the clarifying agents used. The results obtained varied between 86 and 97.8 per cent. of starch, and, although great differences in the dextrose-maltrose ratio were found, a large proportion of the results was within the limits of 91 and 96 per cent. The conclusion is drawn that the taka-diastase method is unreliable, and test experiments should be made upon pure starch with every sample of enzyme before and during use. It is possible that the discrepancy observed is due to the persistence of dextrin, but this has not been proved.—T. J. W.—(Through the *Analyst*.)

A NEW METHOD FOR STAINING BACTERIAL FLAGELLA.—The formula for the stain is as follows:

Tannic acid	10 Gms.
Aluminium chloride (hydrated)	18 Gms.
Zinc chloride	10 Gms.
Rosaniline hydrochloride	1.5 Gm.
Alcohol (60 per cent.)	40 Cc.

The solids are triturated with the alcohol, 10 cc. of which is first used, and the mass thoroughly mixed; the remainder is stirred in slowly till the mass passes into a viscous solution of a deep red color. The solution, which is stable, is diluted for use with water, when nearly complete precipitation occurs, a small amount remaining in solution. The usual precautions for successful flagella staining must be observed. No fixation is required. One part of the stain, say 0.5 cc., is mixed with four parts of water and allowed to stand for one minute, after which it is filtered directly on to the film and again allowed to stand for one minute, when a slight bronzing is visible on the surface. It is then washed under the tap. The film is now flooded with cold carbol fuchsin for five minutes, dried, and examined in oil, and if satisfactory mounted in balsam or euparal The preparations are permanent.—H. G. Plimmer and S. G. Paine (*Jour. Path. and Bacteriol.*, 1921, 24, 286.—(Through *Pharm. Journ. and Pharm.*)

STAIN FOR PHAGOCYTES.—The following solution is recommended for staining phagocytes and exudates:

Distilled water (neutral)	100 Cc.
Glycerol	20 Cc.
Alcohol (95 per cent.)	20 Cc.
Phenol	2 Cc.

In this is dissolved:

Crystal violet	0.06 Gm.
Pyronin	0.20 Gm.

The stain is ready for use without filtering, and it is stable if protected from sunlight and evaporation. Films are made and allowed

to dry in air without heat or other fixation. Staining takes place in five to ten seconds after which the preparation is washed with distilled water. Any excess of water is mopped up with blotting paper, but the film itself should not be blotted. The cell nuclei are stained violet and the cytoplasm of a uniform delicate lavender, the cell limits being well defined. Bacteria are a deep purple. Erythrocytes appear as pale lavender shadows. Plasma cells and mast cells exhibit a characteristic structure and stain darkly throughout, so that they are easily recognized.—H. B. Cross (*Johns Hopkins Hosp. Bull.*, 1921, 32, 51.—(Through *Med. Sci. Abs. and Rev.*, October, 1921, 61.)

French Olive Oil.—According to the British Consul-General at Marseilles, French Olive Oil is not being exported, and will not again be exported in quantity until it is possible to obtain foreign olive oils or the oil seeds. The olive oil exported from France in the past was rarely, if ever, pure Provence olive oil, but a mixture of French and foreign olive oil, often of olive and oil seed oils, after refining. According to the French law, olive oil may only be applied to pure olive oil, even deodorized olive oil may only be called table oil or frying oil—huile table or huile a frire.

Olive oils from Provence are classified in the following grades: Surfine, Fines, Lampantes (enfers), and Ressences.

"Surfine" and "Fine" olive oils are edible, and the terms apply to the results of the first pressings of the olive. For the "Surfine" the pressing is less than for the "Fine."

The terms "Lampantes" and "Ressences" apply to olive oils which *per se* are inedible, but become so after being refined (deodorized). Lampantes oils are the product of poor quality olives, and Ressences are oils extracted from the pulp after pressing the olive stones by the hot-water process.

The quality of olive oils varies according to the districts in which the olives were grown. The "Huiles d'Olives Surfines" from the Bouches du Rhone, Var, and Alpes Maritimes, are generally of better quality than those from the Gard, Vaucluse, or Drome. The quality is a matter of flavor.

"Fines" and "Surfine" table olive oils are generally contained in chestnut wood barrels of 5 to 600 kilos net contents. Ordinary

olive oils, that is, "Lampantes" or "Industrielles," are contained in used mineral or cottonseed oil drums of about 175 kilos net contents.—(Through the *Austr. Chem. and Drugg.*)

WESTERN SNEEZEWEED (HELENIUM HOOPESII) AS A POISONOUS PLANT.—Marsh, C. Dwight, A. B. Clawson, James F. Couch and Hadleigh Marsh.—United States Department of Agriculture Bull. 947: 1-46. 5 Fig., 2 pl. 1921.—The spreading western sneezeweed, Helenium (Dugaldia) hoopesii causes the disease of sheep known as the "spewing sickness" and is also responsible for some cases of cattle poisoning. The poisonous principle, dugaldin, is an easily decomposed, white, amorphous, solid glucosid which forms a sparingly soluble compound with tannic acid. Experiments prove that little can be accomplished in the way of extermination and as yet there is no remedy medicinally. Proper handling of the herds by competent men may prevent most of the losses.—M. S. Dunn.

PRODUCTION OF ORGANIC COMPOUNDS BY MICRO-ORGANISMS.—In his presidential address entitled "The Laboratory of the Living Organism," Dr. M. O. Forster, President of the Chemical Section, British Association for the Advancement of Science, pays tribute to the lowly yeast plant and its close relatives, certain bacteria and moulds. Yeast produces glycerol as well as alcohol. *Bacillus macerans* produces acetone and acetic and formic acids. The following organic compounds have also been obtained by the action of microörganisms: Acetaldehyde, dihydroxacetone, butyl alcohol, butyric, oxalic, succine, fumaric, lactic, citric and pyruvic acids. If the proper genus and species of microörganism be chosen and be given the proper food and the proper environment, it will produce the desired organic compound, and will work 24 hours per day. Certain of these microbiological processes are used on a commercial scale, for instance in the manufacture of acetone and butyl alcohol. (*Scientific M.*, 1921, xiii, 301-308.) (Through *Jour. of Frank. Inst.*)—J. S. H.

MEDICAL AND PHARMACEUTICAL NOTES

Chaulmoogra Oil and Leprosy.—The U. S. Public Health Service has felt it necessary to prevent the too optimistic and extravagant claims recently appearing in the newspapers in regard to the curative effects of chaulmoogra oil derivatives on leprosy. While the use of the oil and of its derivatives has resulted in a considerable number of apparent cures, it is as yet too soon to tell whether these will be permanent.

The ethyl esters of chaulmoogra oil, the use of which has largely supplanted the oil itself, constitute a most valuable agent in the treatment of leprosy. In treating young persons and those in the early stages of the disease, the improvement has been rapid and striking; in older persons and older cases it is less so. Of the cases paroled from the leprosy stations in the Hawaiian Islands so far about 8 per cent. have relapsed and returned for treatment. This was to be expected; and on the whole the results have been so favorable as to make treatment of the disease hopeful. But only time can tell.

Depármtent's Discovery May Be Useful In Human Medicine.—The toll exacted from the live-stock industry by internal parasites such as worms is enormous, and because of this drain on the herds and flocks the zoologists of the United States Department of Agriculture keep up an unflagging search for chemicals and treatments that may be used to combat these organisms. Recently they have discovered that a certain chemical once used in medicine as an anesthetic and now used variously as a fire extinguisher, cloth cleaner, insecticide, and solvent for fats and guns, is very effective as a destroyer and expeller of intestinal worms. The name of this chemical is carbon tetrachloride.

The effectiveness of this chemical against certain round worms has been announced by the department, but what may be the most beneficial use has just been brought out by tests on animals infested with hookworms. In the case of sheep the minimum effective dose

has not yet been determined, but all the doses used, from 12 cubic centimeters to 48, in each case given in 2 ounces of castor oil, removed all stomach worms and all hookworms. It has been equally effective for hookworms in dogs and foxes, and has been used with success against some of the various kinds of worms that infest the digestive tract of pigs.

The fact that a species of hookworm also affects man makes this discovery of the efficacy of this chemical against hookworms in various animals of interest to medical men as well as to veterinarians and live-stock growers. Medical men are now trying it out at several places as a possible cure for hookworm disease in man, and it gives promise of success. As a result of the work so far completed, scientists in the Bureau of Animal Industry consider that this drug will prove of special value in the removal of the various kinds of blood-sucking worms in domestic animals.

Crude Vegetable Drugs Need Careful Drying for Market.—Success in drying crude vegetable drugs for the market depends chiefly upon the careful control of temperature and the flow of air, says the United States Department of Agriculture in a new Farmer's Bulletin, No. 1231, Drying Crude Drugs. The application of a few fundamental principles of drying would result in making more marketable a considerable portion of the vegetable drugs that are gathered. The object of drying is to remove sufficient moisture from the product to insure good keeping qualities. It prevents molding, the action of enzymes, and chemical or other changes which are brought about by the presence of excess moisture.

Crude drugs can be dried either in the air or by the means of artificial heat. Burdock roots, for instance, are split and dried in the sun, while certain aromatic drugs, such as sage, peppermint, and wormwood, are perhaps better if dried in the shade without artificial heat. Belladonna, dandelion roots, and green leaf drugs, are among those which are dried with artificial heat.

Drying in the air varies from merely laying the materials out in the sun to shade-drying under elaborate dry-house conditions. The bulletin gives data on the amount of heat and air circulation

necessary for various vegetable roots and herbs, description of two forms of artificial driers for large and small operations, hints on dry house management, and the care of crude drugs. The bulletin may be had free on application to the department.

Picric Acid for Skin Sterilization.—An investigation as to the relative value of various methods of preparation of the skin prior to operation has been carried out by H. W. Hewitt (*Amer. Jour. Obstet. and Gynec.*, April, 1921, p. 672). For each experiment three areas of skin were selected. A scraping was made from each and placed in culture media; these were used as controls. One of the skin areas was then treated with the antiseptic for one minute, a second area for two minutes, and the third for three minutes. All were washed with sterile water to remove any excess of antiseptic. Scrapings were made and placed in culture media. Using fresh skin areas, the tests were repeated five or more times for each fresh antiseptic.

The methods tested included soap and water, alcohol, ether. iodine of various strength in alcohol and in benzene, picric acid 6 per cent. in alcohol, ether applied for three minutes followed by picric solution for the same time. This last method gave by far the best result, the cultures being negative in every case. Iodine in benzene also gave good results. The ether-picric acid sequence has been tested on nearly a thousand patients at Grace Hospital, Detroit, with most satisfactory results. It is simple, cheap, and efficient; it does not injure the skin, and may be used on any part of the body; it does not injure the peritoneal coat of the intestine; it can be easily standardized. The stain may be removed from the skin with a 5 per cent. solution of sodium carbonate or a 25 per cent. solution of ammonia in alcohol.—(Through the *Prescriber.*)

Preparing Colloidal Gold.—Pietravalle has simplified the technic for the colloidal gold used in the Lange test, and states that he was constantly successful with his new method in obtaining a good suspension. He added to 100 cc. of distilled water 1 cc. of a 1 per cent. solution of gold chlorid and 1 cc. of 2 per cent. solution

of potassium carbonate. This was heated over a flame and, as it began to boil, he added 1 cc. of a 0.5 per cent. solution of glucose and continued the boiling. The fluid in about a minute turns violet and in a few seconds the tint becomes a brilliant purple, and it is then removed from the flame.—(Through *Jour. Amer. Med. Assoc.*)

LOBELIA PLANT; ALKALOIDS OF THE ——. I. H. Wieland. Ber., 1921, 54, 1784-1788.—The isolation of two crystalline alkaloids, lobeline and lobelidine, from *Lobelia inflata* of North America is described. The preparation of the former depends on the observation that its hydrochloride can be removed from its aqueous solution by repeated agitation of the latter with chloroform; the final purification is effected by crystallization from alcohol, benzene, or ether. Lobeline, $C_{23}H_{29}O_2N$, crystallises in broad, colorless needles, m. p. 130°—131° C., $[\alpha]^{15}D = -42.85°$ in alcoholic solution. The sulphate, nitrate, bromide, and chloride are placed in order of increasing solubility in water; they are crystalline neutral salts. The base is monacidic. The oxygen atoms appear to be present in ethereal union since the substance does not react with the usual reagents for the ketonic or hydroxy groups and its stability towards alkali indicates the absence of the lactone ring. The methoxy group is not present. The nitrogen atom appears to be in tertiary form. An unusual property is the ready hydrolysis of the alkaloid to acetophenone, but the fate of the remainder of the molecule has not yet been elucidated. Lobelidine, $C_{20}H_{25}O_2N$, small irregular prisms, m. p. 106° C., is isolated from the final ethereal mother liquors obtained during the preparation of lobeline. Its hydrochloride has m. p. 165° C. after darkening at about 160° C.—H. W.—(Through *Jour. Soc. Chem. Ind.*)

NEWS ITEMS AND PERSONAL NOTES

Develop Manufacturing Processes.—Since chemistry plays an important part in many manufacturing processes, the Bureau of Chemistry has been authorized by Congress from time to time to study processes used in industries directly or indirectly related to agriculture. Studies are under way to improve methods of tanning and testing leather in order to develop longer lasting leathers and to produce leather better suited for specific purposes. Improvements have been made in methods for the manufacture of rosin and turpentine, as well as in the grading of these products. Questions relating to the manufacture of paper for specific purposes have received attention. Studies have been made of problems involved in the utilization of wool scouring wastes and in the water proofing of fabrics for farm use. Investigations were made of the manufacture of insecticides.

In the work on the manufacture of dyes, emphasis has been placed upon the study of the laws that govern the chemical reactions employed in the dye industry and the determination of the chemical and physical properties of the substances of importance in dye manufacture. As a result of these investigations many processes have been developed that are useful in aiding the maintenance of a dye industry within the United States.

Dr. Whelpley, Retiring Treasurer of the A. Ph. A., Sends a Parting Message.—"For thirteen years, it has been my privilege to collect the dues and care for the funds of the A. Ph. A. This was only a fraction of the sixty-nine years the association has served pharmacy and a mere point in the future of the organization but it has been an important period in my life's activities. Since 1852, the A. Ph. A. has been a 'going concern,' increasing in membership, adding to its finances and enlarging its field of activities. In the A. Ph. A., I have found many of my most valued acquaintances and cherished friends. January 1, 1922, I shall transfer the

official trust to another but my personal interest in the members will continue. I know that, beginning with the New Year, Treasurer E. F. Kelly, of Lombard and Greene Strets, Baltimore, Md., will have from you that whole-hearted co-operation in his work, which you have given me in the past."

New N. A. R. D. President Their Guest.—His friends in the professions of pharmacy and medicine on the evening of December 1, expressed their appreciation of the honor that had come to them through the election of Ambrose Hunsberger, of Philadelphia, to the presidency of the National Association of Retail Druggists at the Denver convention in September last. This expression took the form of a dinner at which Mr. Hunsberger was the honored guest of his fellow members of the Philadelphia Association of Retail Druggists. Prominent physicians, educators, city, State and Federal officials, manufacturers and wholesalers were among the 150 who participated.

BOOK REVIEWS

ARZNEIPFLANZENKULTUR UND KRAUTERHANDEL (Cultivation of Medicinal Plants and Herbs). By Th. Meyer, Apothecary in Colidtz. Third improved edition. Twenty-one figures, vii and 188 pages. Julius Springer, Berlin, 1919.

In this excellent and well written book, Apothecary Meyer treats of the growing, handling and use of the medicinal and spice plants which can be cultivated in Germany. Most of these are also suitable for cultivation in other countries of temperate climes including the United States.

The contents of the text are systematically grouped into an introduction, three chapters and a supplement. The introduction includes thirty-nine pages of valuable data on the significance of medicinal herb trade, profitableness of cultivation, general rules of cultivation, rotation of crops, manuring, harvesting, drying, grinding and storage. The three chapters deal respectively with annual and biennial medicinal plants, perennial medicinal plants and undershrubs and woody medicinal plants. In considering each plant the author gives the Latin scientific name, German synonyms and family and then discusses the regions of growth, characteristics, cultivation and harvesting. In a number of instances the yield in kilos per acre is also stated. The supplement includes eleven pages of tables dealing respectively with the loss on drying of freshly collected drugs and vegetables, flower and seed calendars, and indexes of Latin-German names of plants considered in the chapters of the text.

The information contained in the book is based to a large extent upon personal observations of the author, who for many years has had considerable practical experience in growing medicinal plants and harvesting medicinal products. The style of the author is easy and affords very interesting reading. The illustrations, while few in number, are very clear. Since the literature on drug plant cultivation up to the present has been largely scattered and meagre, when compard with other phases of pharmacognic endeavor, Apothecary Meyer is to be congratulated upon his efforts of successfully marshalling scattered facts and interweaving them with so many of his

own observations. The latter represent valuable additions to the science of pharmacognosy. The book should be quite useful to agriculturists, pharmacists, pharmacognosists, gardeners and students of drug plant cultivation.

HEBER W. YOUNGKEN.

A TEXT BOOK OF PHARMACOGNOSY. HEBER W. YOUNGKEN, PH. M., PH. D. P. Blakiston's Son & Co., Philadelphia; 538 pages, 350 illustrations. Retail price, $6.

The rise of Pharmacognosy as an autonomous subject took place not so long ago, and it has been less than three decades since Tschirch thought it necessary to answer at length the question asked him by sundry of his colleagues,—"What is Pharmacognosy"? Tschirch and Flückiger, to whom this branch of science owes so much, laid broad foundations, claiming for Pharmacognosy much from both botany and chemistry, and no small areas from history, microscopy, specialized agriculture, drug economics and even from folk lore. Others have not seen the subject so broadly in its cultural and social relations, but have expanded various technical adaptations. Wearing, therefore, a coat of many colors it is not strange that Pharmacognosy presents different aspects and has not assumed a generally recognized design such as we expect to see worn by such old and less composite subjects as botany and chemistry.

Those whose task it was to teach Pharmacognosy three decades ago found it difficult to find a text that could be used with satisfaction. Maisch's Organic Materia Medica had many good points—also lacked a good many. It was unutterably dry. Power's translation of Flückiger's Principles of Pharmacognosy was interesting and authoritative as far as it went, but both in arrangement and content was hardly adapted for use as a text in American school work. Since that time, American teachers have undertaken the task of making their own books. The result has been a series of works having a pretty strong family resemblance. American needs have been seen by all authors in much the same light and the books responding to these needs have a strongly marked character. A disposition is clearly seen to break up the synthesis of Tschirch and Flückiger, relegating several phases back to the several subjects

from which they were taken. The essential result has been to narrow and sharpen the definition of Pharmacognosy. Among the subjects thus reduced or eliminated are the chemical, historical and other broadly cultural features on which the "fathers" laid so much stress.

As a result the American is typically a treatise of a very definite character. As to material, it deals not with the plants and plant products that are, or have been, used in medicine, but with those that have official recognition. Little information is included beyond that required for school or State board requirements. Structure is dealt with insofar as it is necessary for purposes of identification and others equally practical. As a result of this elimination of most of the content having other than an immediately practical utility, Pharmacognosy in its American development has shown a tendency toward narrowing and hardening itself until it comes to fill but a portion of the original outline.

In general subject matter and general manner of treatment, Dr. Youngken's Text Book belongs to the American family of pharmacognosies. Here the crude drugs of the Ninth Pharmacopœia and of the National Formulary IV are marshalled, first in list form classified on a morphological basis, then in articles making up the body of the work on the basis of taxonomic relationships of the plants concerned. Since the evolutionary system of Engler and Prantl is here followed, the arrangement of the body of this book expresses this advanced botanical concept.

This emphasis on the scientific must be acceptable to those who would see the broader outlook prevail.

In the articles dealing with the individual products, there is everywhere evidence of condensation. In spite of interesting and informing things that might be said, the text is compressed to the least number of paragraphs. In spite of this evident tendency, however, the author has succeeded in doing much to relieve the book from almost inevitable dryness. Abundant illustrations, most of them good, references to the channels of trade through which these things come to us, and occasional sentences dealing with the ways in which products are obtained or treated in foreign lands, give touches of human interest to pages that of necessity must largely consist of technical characterization. He has watched the attempts to grow drug plants in this country. Had his space permitted, a somewhat

fuller presentation of this phase of the subject would have been interesting. But the reviewer knows that space is valuable and that Pharmacognosy texts are usually uncomfortably ponderous volumes. This trouble Dr. Youngken has well avoided as a result of these and other omissions.

The typographical make up of the book is very pleasing to the eye, the binding is neat and promises to hold the book together for a longer period than most of its type survive. All in all, it may be said that Dr. Youngken and his co-workers have produced a very good book that has been turned by the publishers into an attractive and serviceable volume.

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Department of Botany,
University of Pennsylvania.

DRYING CRUDE DRUGS. By G. A. RUSSELL, *Farmers' Bulletin* 1231, U. S. Department of Agriculture. Pages, 16; Figs., 6. Issued November, 1921.

This contribution from the Bureau of Plant Industry will be of interest to all those who are engaged in the collection and handling of crude drugs. Topics considered are: Principles of drying, including exhaustive treatment of the regulation of air flow and of temperature; Methods of drying; drying equipment; drying with artificial heat; and the care of dried crude drugs. This bulletin forms a welcome addition to the series which has been issued from the office of Drug, Poisonous and Oil Plant Investigations. The series comprises descriptions of American crude drugs and the sources from which they may be obtained and should enable any ordinarily intelligent person to collect, identify, and properly prepare for market indigenous medicinal plants.

The druggists throughout the country can render great service to their own industry by encouraging the collection of such drug plants as grow in their neighborhood and for which there is always a market albeit the prices are commonly low.

This bulletin and those which have preceded it should be read by everyone interested in the handling of crude drugs. It may be obtained simply for the asking.

J. F. C.

ORGANIC MEDICINAL CHEMICALS. By M. Barrowcliff, M. B. E., F. I. C., and Francis H. Carr, C. B. E., F. I. C.; 325 pages. Price, $4.00. D. Van Nostrand Company, New York.

This is only one of a series of volumes, edited by Samuel Rideal, D. Sc. Lond., F. I. C., giving a survey of the chemical industries. This particular book takes up the organic medicinal chemicals, both synthetic and natural, and is the work of M. Barrowcliff and Francis H. Carr.

The plan of the book is unique in two respects: First, instead of being arranged in chapters, as is the usual custom, the material is grouped into eleven sections, each grouping being taken up in the manner of a special article or monograph. Second, these groupings have been made, not according to any chemical relationship between compounds, but according to their therapeutic uses.

The eleven sections into which the authors have divided the material are dealt with under the following headings: 1. Narcotics and general anesthetics. 2. Naturally occurring alkaloids and their derivatives. 3. Natural and synthetic local anesthetics. 4. Antipyretics and analgesics. 5. Organic antiseptics and disinfectants. 6. Purgatives. 7. Vaso-constrictors and vaso-dilators. 8. Diuretics and uric acid solvents. 9. Organo-metallic compounds. 10. The digitalis group. 11. Other substances of interest.

The book is one which should appeal to a large class of readers already possessing good text-books. The descriptions are clear and are augmented by a considerable number of illustrations, each throwing light upon some manufacturing process. Structural and graphic formulas are freely used throughout the book showing the steps in the synthesis of chemicals or in order to indicate their properties or to bring out certain relationships that may exist between them. Another helpful feature of the book is found in the use of structural formulas in the balancing of equations.

No attempt is made to deal with all the known synthetic remedies and some of the descriptions are necessarily incomplete. Notwithstanding this the authors have succeeded in presenting a comprehensive survey of this field of industry that a reader can understand without becoming bewildered by a multiplication of details.

To the chemists, pharmacists, physicians and students who are familiar with the large number of important organic medicinal agents, this book should make a special appeal. In dealing with the

industrial phase of these materials, the book is not only of interest, but of practical value.

E. J. HUGHES.

ANLEITUNG ZUM NACHWEIS ZUR TRENNUNG UND BESTIMMUNG DER REINEN UND AUS GLUKOSIDEN (U. S. W.) ERHALTENEN MONOSACCHARIDE UND ALDEHYDSAEUREN.

DIRECTIONS FOR THE IDENTIFICATION, SEPARATION AND QUANTITATIVE DETERMINATION OF PURE MONOSACCHARIDES AND ALDEHYDACIDS, AND ALSO OF MONOSACCHARIDES OBTAINABLE FROM GLUCOSIDES, ETC.

By A. W. van der Haar; 345 pages; 14 illustrations, and 10 tables. Published by Gebruder Borntraeger, Berlin W. 35, Schöneberger Ufer 12.

A very comprehensive and highly technical treatise, containing much original work not previously published.

In the introductory chapter, the author calls attention to the desirability of discontinuing such terms as cerasinose, prunose, scammonose, traganthose, etc., on the ground that these names referred to substances which had been found to be mixtures, and not definite compounds.

Considerable space is given to the description, and to the constants, of the important monosaccharides, and to those of glucoronic and galacturonic acids, which occur as decomposition products of glucosides.

Processes are given for the separation, identification, and the quantitative determinations of arabinose, xylose, rhamnose, fucose, d-glucose, d-mannose, d-fructose, d-galactose, and for the acids mentioned.

The book concludes with complete analyses of the gum of the apricot tree, of the saponin found in wild chestnut, and of the hydrolysis-products of tragacanth gum.

Numerous references to original publications are given in the text.

The book should prove of very great value to all practical chemists engaged in research on carbohydrates, particularly to those who are interested in the glucosides of medicinal plants.

J. W. STURMER.